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WATCHING WASHINGTON

R. S. McBride, EDITORIAL CONSULTANT
J. V. Hightower, WASHINGTON CORRESPONDENT

New trade mark law goes into effect on July 5 . . . Office of Materials Distribution to take over controls on rubber and chemicals . . . Sale of all but two government nitrogen plants contemplated . . . Senate fertilizer bill not likely to receive much consideration . . . Names of nine German scientists cleared by War Department . . . Treasury Department authorizes tank-truck transportation of denatured alcohol . . . Chlorine containers offered for lease by Chemical Corps of the Army . . . Office of Technical Services cut off from funds . . . New stream pollution bill

Pipelines Are Full!

WASHINGTON is diligently studying the economic trends which affect goods. It seems generally the official opinion of economists that one reason for the slow-down of goods movement lately is the fact that inventories have built up all along the supply line from raw material to retail store. Thus these observers conclude that the pipelines are full.

Resistance to high prices by consumers has been another factor. All this has affected consumer goods and many of the raw materials needed for their production. In general, the same situation has not developed with respect to chemicals. However, the over-all picture indicates that inventories will not build up much higher, may have to shrink a bit in some lines, and chemical demand is dropping back much closer to output. Officially recommended is close production control, in order to avoid overstocking and price collapse. When and whether this will apply to major industrial chemicals is not yet clear.

New Trade Mark Law

MANY trade-mark users are expected to register their marks under the new trade mark law which goes into effect July 5. The Patent Office has taken on additional employees to help meet the anticipated first flood of registrants. Despite several provisions of the bill which trade mark authorities would like to see amended as soon as possible, it's generally believed that the incentives to register are valuable enough to offset possible disadvantages.

The two most important features of the new law are registration of a trade mark with the Patent Office becomes constructive notice of a claim to ownership of the mark; and possibility of getting incontestable rights to a mark five years after registration.

Also under the new law, which goes into effect July 5, several other kinds of marks that were previously unregisterable can now be protected by filing with the Patent Office. For instance, a family name has heretofore been unregisterable. Now it may be registered and incontestable rights may be won by the registrant.

Rubber Allocations Set

RUBBER controls were relaxed again last month when manufacturers were permitted to use additional amounts of natural rubber in 65 different groups of products. Mostly miscellaneous rubber products were affected: no increase in natural rubber was allowed for auto tires and tubes. The amount of natural rubber now permitted to be used won't be increased again for several months, according to agency officials, unless unanticipated quantities of natural rubber become available in this country.

Fundamental changes in rubber production and use hinge upon crystallization of a permanent rubber policy through legislation. Congress last month took the first step in this direction when it began hearings on a permanent rubber policy. Questions to be decided (during the next session of Congress, not this one) include decisions on what level of American rubber production is necessary for national security, how many of what kind of plants must be maintained in standby, how best to insure use of American rubber in products, and how and to what extent is further research in synthetic rubber to be carried on by the government, and by private industry.

Congressional hearings scheduled for earlier this month aren't likely to be exhaustive. The whole question probably will be reopened before bills are placed on the schedule for passage next year, and interested parties permitted to submit their current opinions in testimony at that time.

Rubber, Chemical Controls

A NEWLY-CREATED Office of Materials Distribution was formed at the Department of Commerce last month to inherit a part of the now-disintegrated Civilian Production Administration. OMD exercises what is left of the controls CPA had over critical materials. Four materials divisions have been set up in OMD to carry out control programs still in effect for rubber, chemicals, i.e., streptomycin and cinchona bark, tin and antimony, and manila and agave fiber and cordage.

Streptomycin producers, in meetings held in Washington, agreed that continued export controls are necessary to meet U. S. needs this year, but voiced divergent opinions as to the necessity of continuing the present system of allocations among the military, civilian, and research users of the drug. The majority felt, however, that the allocations should be continued until new production facilities are in operation, and extent of domestic demand becomes known. Promising research projects now under way, for instance, may create sudden demands for the drug which would be beyond industry's ability to supply.

All Spoken For

ALL BUT two of the ten government financed nitrogen fixing plants built for war purposes will be taken by industry under lease or purchase

contracts, if chemical companies have their way. These two will be used by government agencies, one by Tennessee Valley Authority and the other as a demonstration plant making synthetic liquid fuels by the U. S. Bureau of Mines. This is the present situation, quite in contrast with the expected problem of surplus property disposal.

The explanation is, of course, that nitrogen demand far exceeds in peacetime the wartime requirements. The conflict between important groups of "claimants" attempting to get nitrogen compounds has become quite bitter.

During May and June the government is having three of the arsenals operated for it to supply ammonium nitrate. As soon as possible the Army, which made these contracts, wants to put these three arsenals back in the hands of War Assets Administration. Then WAA will complete negotiations for leasing them to present operators. The three are: Morgantown operated by Heyden, Cactus operated by Spencer, and West Henderson operated by Allied Chemical. Each of these three companies has indicated that it wants to get either a term lease with privilege to buy or an immediate purchase contract.

Army Nitrogen Mystery

It is interesting that present emergency operations have caused so many headaches for the Army that it is seeking to get return of the projects at the earliest possible date. It even tried to have the Department of Agriculture take over these projects on the ground that the operation was to make fertilizer. But Secretary Anderson was smart enough to avoid, at least for a time, the responsibility for this headache job. Both War and Agriculture officials hope that WAA can get return of them, and soon. Then the transfer to industry will take place promptly and official management responsibilities will end.

Meantime the Army is very vague as to what has happened to nitrogen-producing facilities abroad, even those in the American zones of occupation. Rumors that some of the foreign nitrogen plants have been destroyed to reduce war-making powers have been denied by high War Department executives. But Washington inquirers remain nervous.

Seriously proposed is an official inquiry as to the exact status of every foreign nitrogen-fixing plant. Also wanted is factual information regarding what it would take to put them into operation again. Thus American officials would know whether foreign countries are padding their requests for aid from this nation when the actual allocations of production start for the next fertilizer year which will open on July 1.

Cabinet Controversy

There are four major competitors for nitrogen chemicals being made in the government wartime arsenals. Each of these claimant groups is represented, or should be, by a Cabinet officer. Most of the controversy has been kept under cover, but it has been nonetheless bitter and prolonged.

The War Department wants to get generous supplies of nitrogen fertilizers to use in occupation areas. The State Department would like to be generous with other countries in its international dealings, so that they could grow more crops and feed themselves more comfortably. Farmers seem to be unlimited takers of fertilizer nitrogen, and the Secretary of Agriculture is correspondingly vigorous as a claimant on their behalf. Extremely important, but not too actively represented, are many process industries needing nitrogen chemicals for purposes other than fertilizer. The Secretary of Commerce has not appeared as an aggressive claimant on behalf of his constituency.

All these difficulties at high official level are causing John Steelman many troubled hours. It is his problem to work out for the President some formula for peace in the Cabinet. Present trends toward making of more industrial chemicals instead of ammonium nitrate for fertilizer promise to aggravate the problem for the remainder of 1947.

Senate Fertilizer Bill

Ten Senators joined as sponsors of S. 2531, the bill introduced into the Senate in May as a companion to the House bill, H.R. 2494, or Flannagan bill. This is the proposal which would put the United States Government much further into the fertilizer business, especially in the southwestern and inter-mountain states.

It is very unlikely that the bill ever will get serious attention in the Senate Committee, even though Chairman Arthur Capper is one of the nominal sponsors. The House bill also has prospect of gathering dust in the pigeonhole of the House Committee on Agriculture for months to come.

Two interesting theories are advanced as to why ten Senators should join in this sponsorship. One is that by having a group, each could divide the expected criticism with a considerable number of fellow members. The other theory is that they all got tired of being bothered by Edward O'Neill, head of American Farm Bureau Federation, and figured that this was the easiest way to get him out of their hair. Obviously many, if not most, of the ten do not favor the legislation. But the industry still plans to watch the measure closely, so that they may be ready to pounce on it vigorously if it even wriggles toward passage.

Monopoly Charged

The Department of Justice last month again charged nine corporations and nine individuals with conspiracy to restrain and monopolize production and distribution of chlorinating equipment in violation of the Sherman Antitrust Act. The defendants are those previously indicted for the same offense by a Federal Grand Jury last November. They were not tried as a result of the court's holding that the Grand Jury had been illegally constituted.

The Department of Justice stated that the case was filed "to relieve public agencies from the evils resulting from monopolistic practices." Chlorinating equipment is sold mainly to municipalities, and state and federal agencies.

German Scientists

War Department last month had cleared the names of nine high-ranking German scientists who were being sought by industry, universities, research laboratories as additions to their research staffs. These nine were from a group of 16 recommended for clearance by the Joint Intelligence Objectives Agency. However, some doubt has been expressed as to whether even these nine would be admitted to this country for "civilian industrial use," as contrasted with the 300-odd scientists now in the U. S. working on Army projects under direct Army supervision.

Political considerations are such that no government agency wants to be responsible for the decision that will permit their entry or for implications involved in having Germans working on research close to this country's own security, free from strictest military surveillance and control.

Inquiries pouring in from university and private research laboratories re-

He talked *Chlorine* into an industry

"A great talker"—so a biographer describes James Watt, brilliant father of the steam engine. One can almost visualize him as he regaled his father-in-law, MacGregor, with the time-saving advantages of using "oxygenated muriatic acid" in his bleach works. Chlorine was thus talked into the first commercial bleaching application—an application that changed the entire character of an industry.

From this experimental beginning, the bleaching powers of Chlorine have been utilized with inestimable value in the textile and paper industries. In its comparatively new role as the versatile tool of chemical synthesis, Chlorine is helping to bring many new refinements to our civilization . . . a civilization it has protected from pestilence through its well-known germicidal properties.

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veal a high degree of interest in scientists in the chemical, metallurgical, synthetic fuel, and food fields. Outlook, however, is for the Army's own program to be restricted due to budget curtailment, and for the State Department to continue to confess inability to process these scientists for visas, as the department has done all along.

Alcohol by Tank Truck

The Alcohol Tax Unit of the Treasury Department last month authorized peacetime transportation of tax-free alcohol and alcohol byproducts in tank trucks, thereby making permanent the temporary emergency authorization instituted as a wartime measure. The rules permit transportation of denatured alcohol, specially-denatured alcohol, fusel oil, butyl alcohol, acetone, and ether in tank trucks of 2,000 gal. capacity or more.

Prior to the war, the Tax Unit prohibited tank truck haulage of alcohol and its byproducts, mainly on the fear of possible loss of tax through hijacking or other diversions to illegal uses. However, under wartime emergency regulations, tank trucks hauled almost 300 million gallons of alcohol (with a tax liability of more than $5 billion) without loss. Only opposition to making permanent the wartime authorization was registered by representatives of the railroads.

Permits to transport tax-free alcohol and other products will be issued only to carriers engaged in legitimate transportation and possessing adequate facilities to assure safe delivery. Carriers must post a $50,000 bond for each truck. Each truck load must be delivered to a single consignee; no split deliveries are permitted. Proprietary anti-freeze solutions may be hauled in tank trucks under the new permanent regulations, but only for one manufacturer between the producing plant and the packaging plant.

More Enemy Reports

Representatives of technical societies and government agencies have been rushing to the United States many reports and microfilm reproductions of German records and all results of field inquiries. These are piling up at Office of Technical Services in huge numbers. Apparently at the beginning of the next fiscal year there will be about 400,000 items from American, British, and French investigators ready for review and release by OTS.

What will happen to these during the coming fiscal year will depend on action of society and industry representatives. The government men have no expectation of being able to screen and classify by subject, ready for release, more than a minute percentage of the total. They are, therefore, putting it up to outsiders to suggest ways and means for handling the material. Industrial cooperation will be welcome, in fact will probably have to supplement largely any society efforts, or most of this crude information material will remain unused and unusable.

Containers Offered

About 1,900 chlorine containers, each of one-ton capacity have been offered for lease by Chemical Corps of the Army, in order to speed chemical movement by rail or truck. As offered, these were practically ready for use for chlorine, but did require insertion of new fusible plugs to meet ICC rules. Use for ammonia, propane, or other industrial gas was suggested. Arrangements for rental are being made with the Contracting Officer, Edgewood Arsenal, Maryland.

Chemical Corps was encouraged to take this action because of its interest in getting maximum possible use of the four arsenals leased to industry at Edgewood, Huntsville, Pine Bluff, and Denver. Two of these began operating early in the spring, and the last two were scheduled for substantial scale operation before the end of May. Earlier operation was prevented by difficulties discovered in arrangements of the arsenals for standby. Engineers now admit that they know a lot more how to prepare caustic-chlorine equipment for long-time idleness. This, they believe, will be very important if ever it is necessary to start up such equipment on short notice.

Research Policy Plans

Research policy for Uncle Sam is being covered currently by a series of reports from the special advisers of President Truman, working as Presidential Research Board under the chairmanship of John R. Steelman. Scheduled for release during June have been two factual reports on scientific personnel and on medical research. Expected later are three other reports on: The federal research program; policy recommendations; and administrative plans for carrying out such policy.

Generally agreed on in Washington is the idea that National Science Foundation should first be established by the pending legislation. Then the rest of the federal research program can have review and recommendations of competent research minds before the balance of a permanent set-up is authorized.

It has been known for some time that the President strongly favors the enactment of the bill which has been favorably reported to the Senate with concurrence of all of the groups which have been working and arguing over it. Thus, it is expected that the Senate will pass S. 526 this spring. Whether the House of Representatives will speed up its activities enough to reach the companion measure or the Senate passed bill, remains uncertain.

All normal types of federal research are likely meantime to be cut back a bit by the economy program of Congress, regardless of policies fixed for the long term.

Magnesium Plant for Sale

War Assets Administration last month began taking an inventory and making an engineering study of the Basic Magnesium plant at Henderson, Nev., as the first step in arriving at a decision on disposal of the main production facilities of the property. At present, six chemical companies occupy subsidiary portions of the plant on five to ten-year leases, which, together with warehousing space leased by a movie company, constitute about 35 percent of the plant.

The engineering survey will cover four questions of disposal: possibility of use of the property as a single unit; other methods of disposal, such as subdivision of the project for unit sales; possibility of continued operation by the government under a multiple-leasing arrangement; and fair value of the property either for sale or leasing.

Tentative plans call for the engineering survey to be completed by July 15. WAA hopes to determine its disposal method shortly thereafter, and ask for bids August 1. WAA officials admit that there is only a remote possibility of selling the plant as a unit, equipment intact. They also see little salvage value in cannibalizing the equipment, which is too specialized to be adaptable for use in other process industries.

OTS Gets the Axe

The House of Representatives has refused to go along with its appropriations committee, and cut out completely any funds for the Office of Technical Services. OTS was vulnerable because its activities has not been

As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

SPEEDAIRE twins save space, reduce weight, cut cost $385

THESE two Speedaires are installed in the northern New York mill of a well-known paper company. The reducer in the foreground drives a paddle wheel circulating hot-pond water; the other drives a chain conveyor bringing rough wood into the hot pond.

In operation over a year, the Speedaires are completely satisfactory. As is apparent from this photograph, they saved valuable space, permitting motors and drives to be grouped more closely. Load on the floor was reduced 1300 pounds (Speedaire's weight is less than half that of a conventional worm-gear reducer) and cost saving was $192.50 per unit.

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authorized by specific legislation. Hence, on a point of order from the floor, the appropriation could be eliminated and it was.

OTS, which had nearly $3.5 million to finance its program during fiscal 1947, thus was doomed, and steps were taken immediately to cancel the research contracts let under the $1 million program of the Industrial Research and Development Division of OTS. The publications operation which had sponsored the acquisition, and publication of technical reports and documents from German industry, was likewise headed for the scrap heap.

Domestic research projects totalling more than $700,000 had been let or approved by the OTS review committee when the appropriations were cut off by House action. Most of these had been on technical problems relating to housing.

Inventions Needed

National Inventors Council has listed 25 technical problems of great interest to the Armed Forces and asked that any proposed solutions to these problems be forwarded to the Council at the Department of Commerce. Among the important targets for technical men were these: Solidification of soils to support emergency operation of aircraft or vehicles; storage batteries for low temperature operation; low horsepower gas turbines; ultra light-weight gasoline engines from one to five horsepower; new fuels and lubricants for use in extremely hot or cold climates; plastics or plastic-metal combinations for use as structural members of bridges, etc.; dry development of photographic film; prevention or corrosion and deterioration; and scale-free salt water evaporator.

Stream Pollution Bills

The drive to enact far-reaching stream pollution legislation yet this year was being carried forward last month, and it was touch-and-go whether both Houses could get together in time to push a bill through. Tentative compromise agreements reached before Congress convened this year between the forces for a "hard" bill and those for a "soft" one seemed to have broken down and without close co-ordination and cooperation between Senate and House groups, passage of a bill this session is doubtful.

The Taft-Barkley bill, on which testimony was heard last month by a subcommittee of the Senate Committee on Public Works, hands stream pollution control, with enforcement powers, to the Surgeon-General as chief of the Public Health Service.

Gen. Fleming's Bill

Last month, however, General Fleming, head of the Federal Works Agency, offered a bill of his own which would transfer the engineering and construction phases of the law to FWA. General Fleming's point was that these functions already are being performed by public works, and that there was no need to set up a parallel agency to exercise the same functions in the Federal Security Administration.

Other important points in General Fleming's proposed bill: it authorizes funds for state health departments to do most of the survey work and authorizes advances from Federal funds for plan preparation. It also provides for Federal loans to states for construction projects, instead of outright grants.

The Fleming proposal would omit important features of S. 418, sponsored by Senators Taft and Barkley. There would be no Federal authority, under General Fleming's bill, to bring a state or state agency into court, and it drops the provision for loans to private industry on the theory that abatement of water pollution is primarily a public responsibility. It would leave programming and surveys, and all health aspects of the problem in the Public Health Service.

FPC Showdown Next Year

Controversy over contracting the power of the Federal Power Commission over natural gas won't be settled until next year, it appeared at the end of last month. Republican party leadership in Congress in establishing legislative priorities have slowed down those Congressmen who have been pushing for gas legislation this year.

Thus there will be at least a six months' period during which opposing forces may gather their strength for the final showdown. To this extent, FPC had gained the point it had been making all along: that amendments to the Natural Gas Act should not be made until all the results of its investigation of the industry were completed. The remaining sections of its report are expected by mid-July.

In the meantime, FPC has already beaten a strategic retreat by agreeing publicly with its critics who feared administrative extension of FPC's authority over more and more phases of natural gas production, transportation, and pricing. Despite FPC's conciliatory moves, it appears that the Rizley bill (which would curtail FPC power drastically) could have passed both Houses this session. Its chances in the Congress convening next January appear equally good.

One intangible factor, which can't be weighed at this time, is the effect of next winter's anticipated shortage of natural gas, which is expected to exceed last winter's shortage in severity and in number of people affected.

Oil Paint Fire Hazard?

Oil paint manufacturers and their suppliers were jolted at the President's National Fire Prevention Conference last month when they got wind of a recommendation being drafted by a committee on building construction. Recommendation was that the use of oil paints be greatly limited for use on inside walls and ceilings of buildings. Idea was that use of cold water paints would eliminate fire hazard, especially in buildings in which walls have been painted and repainted many times.

Minor News Glimpses

Flammable fabrics control has bogged down despite serious attention in the House of Representatives Committee. Apparently the bills proposed were so broadly drawn as to stir industrial opposition, which will probably delay enactment for at least a year.

Synthetic liquid fuels funds of the Bureau of Mines will be limited. But the Bureau thinks it can proceed with initial reconstruction at Missouri Ordnance Works to convert it during the coming fiscal year from ammonia to fuels synthesis.

Safety instructions for handling ammonium nitrate are being studied by Manufacturing Chemists Association. The result will be one of its standard Safe Practice sheets covering packaging, labeling, storage, and handling of this chemical.

Few technologists are being dropped by the government in either scientific or engineering groups, despite heavy cuts in appropriations. Nevertheless it is noticed that a number of industries are finding government technologists more available for industrial offers than heretofore.

CHEMICAL
ENGINEERING
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ESTABLISHED 1902 JUNE 1947 SIDNEY D. KIRKPATRICK, Editor

On Keeping Young—Industrially

CELEBRATION this month by the Manufacturing Chemists' Association of its Diamond Anniversary was an occasion for contemplation as well as congratulation. Seventy-five years is no mean existence for any industrial organization. Yet anyone who knows anything about the American chemical industry will agree that it has made only a mere beginning in its eventual growth and development. Perhaps its most brilliant achievement has been its ability to remain young and vigorous throughout the years.

Much of this youthful vigor stems from research. Chemical industry is changing continually. One new product or process succeeds another long before the latter's life cycle is even approaching completion. The growth curve of the industry as a whole is, therefore, a summation of hundreds—perhaps thousands—of components, most of which are in a period of vigorous and rapid development.

Chemical industry is essentially a young man's industry. According to the National Roster in 1945 more than 70 percent of its 70,000 chemists and 80.9 percent of its 25,000 chemical engineers were not yet 40. In the case of the chemical engineers, 93.5 percent were under 50. These are the men most responsible for the great technological contributions the industry made to the war effort—and is continuing to make in its spectacular peace-time advances.

Chemical management is likewise deserving of credit and tribute. There is scarcely a company in the MCA membership that has not drawn on its resources for younger and more active leadership. Yet age in years is not always a safe index of youthful vigor and enthusiasm. As Mr. Munson spoke at the Skytop meeting, we were reminded of the early history and subsequent development of one of the great companies in the alkali industry. How its founder, dead broke at 60, had established and become recognized as the father of the plate-glass industry. How at the age of 80 he turned to the chemical industry and for a dozen years actively directed the two companies he had founded. Today those enterprises have been consolidated into Wyandotte Chemicals Corporation and a third generation of management is pushing forward with an important program of expansion and diversification into many new fields. Its top executives are in their late thirties, but immensely proud of the high proportion of their employees with service records of 25, 35, and 40 years.

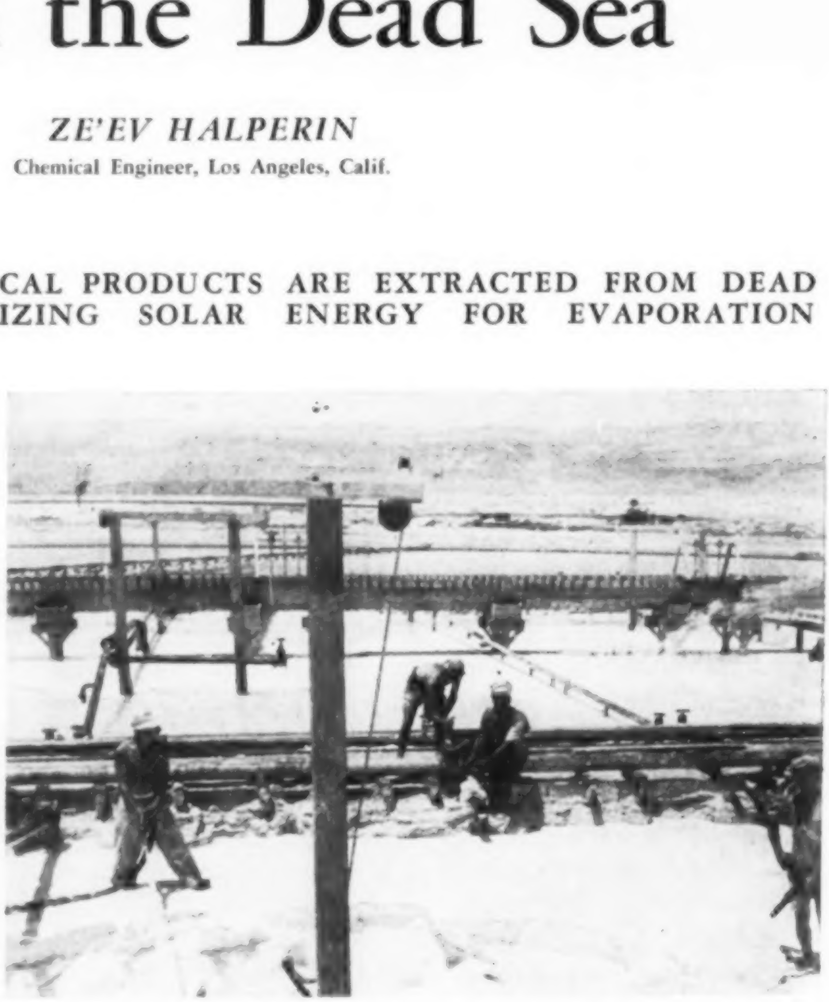
Farther to the north in Michigan, the little bromine plant built by the late Dr. Herbert H. Dow has just celebrated its fiftieth birthday. From this pioneering use of Midland's brines and brains has sprung a great chemical industry producing many hundreds of basic chemicals indispensable to industry and agriculture. Today, after a half century of productive effort, a second generation of management notes "not the passing of time, but the accumulation of knowledge and experience. . . not the 50 years that have gone, but the 50 years to come. . . (in which) to keep chemistry at work for the common good of all."

The problem of keeping young industrially is not so much a matter of years as of attitude and action. Chemical industry is fortunate in having been guided by men with their eyes on the future, who have been willing and able to translate their visions and plans into serviceable plants and processes. "Today," said Mr. Munson, "the frontiers of chemical industry are as distant as they were 75 years ago!"

CHEMICALS From the Dead Sea

ZE'EV HALPERIN
Chemical Engineer, Los Angeles, Calif.

HOW VALUABLE CHEMICAL PRODUCTS ARE EXTRACTED FROM DEAD SEA BRINE BY UTILIZING SOLAR ENERGY FOR EVAPORATION



Carnallite deposited in the evaporating pans is slurried and pumped to the plant about a mile away

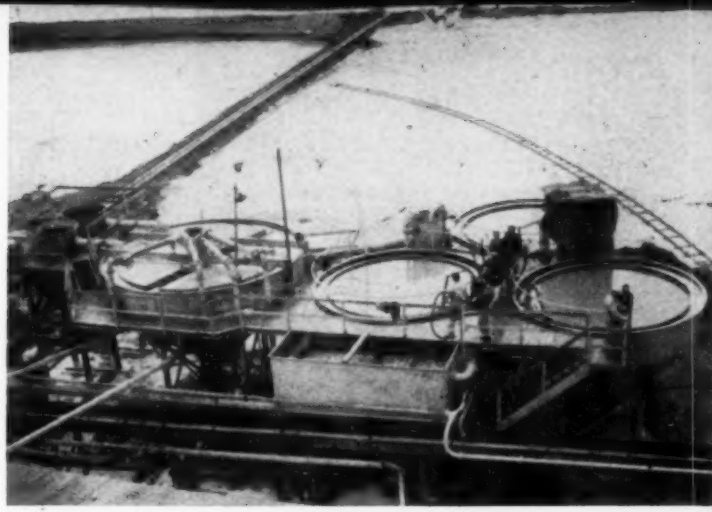
Natural salts of the Dead Sea are now being recovered. Only by application of modern chemical engineering methods has it been possible to tap this vast reservoir of chemical resources. Overcoming many natural and economic barriers, Palestine Potash Ltd. has been successful in laying the cornerstone for a real chemical industry in this country. The author has just returned from Palestine where he had the opportunity to inspect the Dead Sea operations.

THE story of Sodom and Gomorrah, according to geological evidence was not the product of pure imagination but rather a poetic statement of a terrific impact of physical forces thrust upon the face of the earth. Thus, eons ago there occurred a series of earthly disturbances which resulted in a zone of geological dislocation eminently illustrated by the Dead Sea and the Jordan Valley Depression.

This dislocation extends from the north of Syria through the Jordan Valley, the Dead Sea, through the Red Sea to the mountain ranges of central and east Africa. Whereas in other places along the path of this dislocation nature chose to set up mountain ranges, it ripped the earth's surface and formed a deep depression along the Jordan Valley dropping to 1,300 feet below the level of the Mediterranean. Here is the world's lowest spot. Between the Jordan Valley and the Gulf of Akaba a process of erosion from the mountains resulted in a higher level of the Wadi el Araba, the latter being a natural continuation of the Jordan Valley Depression. Thus the Dead Sea forms a dead end lake without an outlet.

In such lakes the evaporation losses are offset by the inflow of the feeding rivers; if these rivers carry with them various salts (as is the case with the Jordan River and its tributaries) these salts are added to the salt content of the lake. There is some evidence that in addition to salts received by the Dead Sea from the Jordan there are also some sub-sea springs which are

Storage tanks at the extraction plant



Classifier and thickeners for treating the carnallite slurry

salt-bearing. The Jordan River, its tributaries and probably the sub-sea springs flow over salt-containing beds and thus add continuously to the salt content of the Dead Sea. It is evident then that contrary to what its name implies the Dead Sea is not static by nature.

In size, the Dead Sea measures 47 miles long by 10 miles wide and has an approximate area of 230,000 acres. Its salt content and the brine concentration at a depth of five meters is given in the table. The influx of KCl from the Jordan River is estimated at 40,000 tons per year. The sea has a salt concentration of about eight times that of ordinary ocean water. Specific gravity of the Dead Sea brine is 1,1725 at 23 deg. C. This concentration increases considerably with depth. Ordinary sea water contains only about 35 grams of salt per liter as compared to about 275 grams for the Dead Sea.

Into this vast chemical reservoir came the 20th century with its know-how and its disregard of natural barriers. Application of modern methods by Palestine Potash Ltd. resulted in the economic extraction of potassium and bromine salts. This concern received a concession ". . . to acquire, on the areas submitted to them for utilization by evaporation or by other means the mineral salts, minerals and chemicals in or below the waters of the Dead Sea, to place them on the market and to sell them."

This concession was to run for 75 years starting January 1930 with certain provisions as to minimum production. These minimum quantities have been exceeded from the inception of operations. Royalty is paid to the governments of Palestine and Transjordan; it is paid to the latter because some of the evaporating pans are situated there.

Climatic conditions prevailing at the Dead Sea were conducive to the establishment of an extraction industry. Solar evaporation proved a most valuable asset next to the richness of the sea. Compared to similar industries in other countries the climatic conditions plus the quality of the Dead Sea brine made salt extraction relatively simple.

Except for a very short rainy period in the winter solar evaporation was depended on for taking out of solution the valuable salts. Maximum sun temperatures reach 149-167 deg. F. It has been found that about 630 cal. per sq. cm. per day of solar energy is available in this area.

Extraction Methods

The processes of extraction are based on supplying the proper conditions for the crystallization out of solution of the valuable salts and separating them from those of lesser value.

Large evaporating pans were constructed at the company's two plants; the location of these plants was determined by the availability of more or less level ground for the accomodation of pans over 4,000 acres in total area. An air survey of the Dead Sea location and terrain reveals only two such areas: one at the extreme north near the point where the Jordan discharges into the sea and one in the south. The rest of the Dead Sea shore is of mountainous terrain. The two plants were therefore established at Kallia and Sodom.

The pans were formed by the erection of wooden earth-filled dams interconnected and equipped with sluices for allowing regulation of flow from the initial point of intake to the final discharge of the spent brine to the sea. The bottom of the pans was left in their natural condition since permeability was not too great a factor.

Dead Sea Salt Content and Concentration

Salt	Brine Concentration at 5 m. Depth, G. per Liter	Estimated Salt Content, Millions of Tons
Kel	11.8	2,000
$CaCl^2$	33.0	6,000
$MgBr^2$	3.9	980
NaCl	82.4	11,900
$MgCl^2$	142.4	22,000
$CaSO^4$	1.3	
Total	274.8	

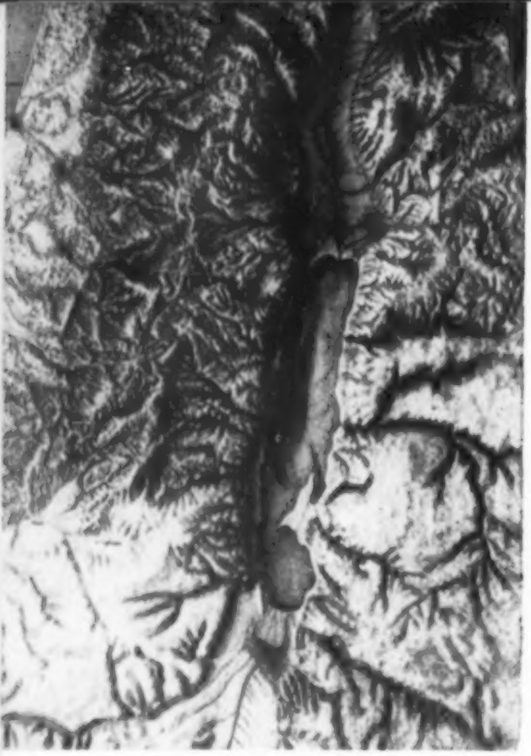
Hataasiya, 11, No. 5., Oct. 1946, Tel Aviv, Palestine.

Sea water is continuously pumped from a depth of 175 feet through a 30 in. welded steel pipe into the pans from a point over half a mile from the shore. It was found that about 50 percent more potash and bromine was present at this depth (where the specific gravity is 1.22) than at the surface. A small quantity of a dark organic dye is added to the brine and acts as a radiation absorbent to increase the efficiency of solar evaporation.

The sea brine moves slowly by gravity, zigzag fashion from one pan to the next; as it progresses the brine becomes more concentrated. When upon evaporation of the liquid the saturation point of NaCl is reached in the primary evaporating pans the salt is crystallized out of solution and is deposited on the bottom. Upon reaching the secondary pans with further evaporation taking place the double salt carnallite together with some adhering NaCl is deposited. Carnallite ($KCl.MgCl_2 6H_2O$) forms the basic raw material for the processing of KCl in the plant.

The brine, after deposition of carnallite, contains all the bromides and is pumped from the pans to the bromine branch of the plant for separation of bromides and further treatment. When several inches of Carnallite deposit on the bottom of the pans it is slurried and pumped to the plant about a mile distant.

In the plant the carnallite suspension is first received in settling tanks where it settles and the overflow of the mother liquor is returned for reworking. It is washed in these primary settling tanks with a "neutral" brine; this brine is high in magnesium content and therefore is non-reactive with the carnallite. Next the material is treated with "decomposition" brine (low in $MgCl_2$) which reacts with the



Topographic map of the Dead Sea Area

carnallite to dissolve the $MgCl_2$ leaving behind KCl in fine suspension.

From there the KCl suspended in brine is pumped via mixers to a static classifier where the large crystals of carnallite separate from the fine ones of KCl and NaCl. The fine KCl suspension is pumped to thickeners. That portion of the brine which still has large crystals of carnallite is pumped to mixers where it is further treated with decomposition brine. The two slurries are joined and pumped to elutriators which separate out the large NaCl crystals. From this point the slurry goes through a continuous drum filter consisting of four units and the material is treated as follows: (1) It is washed with decomposition brine high in $MgCl_2$ and is filtered into the second unit where the material receives (2) a wash with light brine which is high in KCl but low in $MgCl_2$; this removes some of the NaCl still present. It is then refiltered into the third unit where it (3) receives a wash with water and light brine which has no $MgCl_2$ but is rich in KCl. Another filtration brings the material to the fourth unit where it is (4) washed with plain water and is refiltered.

From the last unit the potash is conveyed to Nutsche filters. These are in the form of long narrow tanks, the bottom of which is fitted with a perforated metal floor; underneath the floor there is a special matting. The principle of these filters is much like that of a Buchner funnel. By means of suction pumps the water is sucked out of the potash.

When this mechanical water removal is complete, the potash is carried mechanically to direct heat continuous dryers. After drying and cooling it is sacked ready for shipment. A final purity of 97 percent attained in the commercial product. Small amounts are refined to 99.9 percent for sale as such.

Bromine & Chlorine

The raw material for the production of bromine and its salts is the brine from which carnallite has been removed. It is fed into the top of a standard Kubiersky column in which steam and chlorine are introduced in the bottom resulting in bromine and chlorine mixtures. After separating, the bromine is bottled and ready for shipment. Chlorine is produced by electrolysis of KCl in a series of standard Vorce cells with KOH as a byproduct.

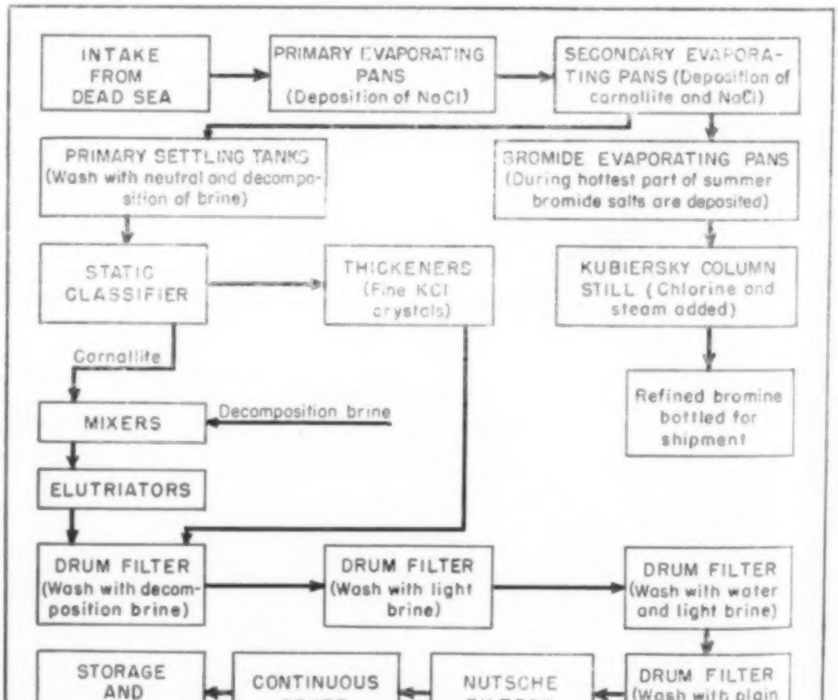
Finished products are brought from the plants to Jerusalem by trucks, transferred to freight cars and taken to the port of embarkation at Haifa whence ships take them to their markets. Most important item and the one produced in greatest quantities is potash; its use is mostly in the fertilizer industry where it forms one of the main chemical components. Besides its use as chemical fertilizer it also serves as the raw material for the production of the whole family of potassium salts which are used in many and varied industries. Bromine and its salts are used in the organic chemical industry, in the photographic industry, in medicine and in the production of high octane gasoline.

The high metals content of the Dead Sea waters is in itself a great promise for future developments. The company looks to the time when power supply will be cheap enough for the establishment of a light metal industry.

Walter Clay Lowdermilk, Assistant Chief of the U. S. Soil Conservation Service, in his book "Palestine Land of Promise" proposed a scheme of utilization of the Jordan River for irrigation and taking advantage of the difference in level between the Mediterranean and the Dead Sea for the production of hydroelectric power.

In its essence this program calls for the diversion of the sweet waters of the Jordan River and its tributaries for irrigation of the Jordan Valley Depression and parts of the south of Palestine. To make up for the loss of flow to the Dead Sea water from the Mediterranean will be introduced by a systems of canals and dams. The difference in height of 1,200 feet will make possible the production of about a billion kw.-hr. of electric power per year. Should this plan ever become a reality it will no doubt permit the establishment of other electrochemical and electrometallurgical industries.

Flow diagram of the extraction process



Vibrating Screen Estimation

H. L. BULLOCK

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Owing to the wide range of types and different kinds of construction used by the various vibrating screen manufacturers, it is difficult to establish formulas or to construct charts to cover the cost of screening equipment. Vibrating screens at one extreme include simple models having the screen cloth fastened directly to wooden or metal frames mounted on leaf or helical springs and vibrated by a single rotating offset weight or lift cam. At the other extreme are elaborate units incorporating special screen cloth mounting devices, compound rubber supports and balanced adjustable vibrating mechanisms. Further possible price variation is introduced by the numerous methods which have been developed for giving motion to the screen surface, which include electrical vibrators, cams, cranks, offset weights and positive eccentrics.

Screen Cost Limits

In an effort to produce data of value to the design and project engineer, it has seemed advisable to prepare two curves defining maximum and minimum costs with the idea that the engineer will select the proper price range on the basis of the type plant he is laying out, and the amount of money available for process equipment. Needless to say, there are no degrees of design refinement which have not justified themselves in commercial installations. Fig. 1, embodying these two curves, has been developed to establish the price range for different screen areas. When used with the factors noted, it will give fairly accurate costs for commercial units ranging up to 50 sq. ft. of screening area per deck. The two basic curves cover the cost of screens of single deck, open construction, while percentage figures are listed covering additions to these basic costs to include multiple decks, partial and total inclosure, and special metal construction.

Accurate use of Fig. 1 depends on reliable information as to the number of square feet of screen area needed to make the required separation. Unfortunately there are no charts which will accurately determine the rate of screening of a new material. Screening rates vary greatly according to moisture or oil content, tendency of the material to generate static charges, shape of the particles, and the percentage of near-size material present in the feed. Variation in screening rates also arises from the type service in which the screen will be used. Every effort should be made to determine an accurate rate of screening in order to select a screen of proper area. Furthermore, it should be noted that the screening rates of various materials will vary materially with different kinds of screen construction and with different types of vibration.

There was a time when screening concerned itself only with the grading of dry materials on a basis of difference in particle size, but that is no longer the case. Modern screening deals with scalping, fluffing, dedusting, dewatering, dry sizing and wet sizing.

Kinds of Screening

Scalping is the rapid screening of a substance through a mesh of relatively large size, to remove large pieces of foreign material or to break up soft aggregates of the substance prior to its delivery to delicate processing equipment or to bagging or packaging machinery. Scalping is good insurance against damage to equipment and it is not an expensive operation, owing to the high capacity of the relatively large mesh screens used. For instance, cement is scalped through a $\frac{1}{8}$ x 3-in. mesh at the rate of 40 bbl. per square foot per hour prior to final bagging.

Fluffing, which may be combined with scalping on a two-deck screen, is the process of breaking up soft aggregates of material so that it may be fed to a mixer in a uniform condition to promote rapid mixing with other substances and to distribute the material over a maximum area. This operation is particularly valuable when small amounts of a powder must be mixed with large volumes of other substances as in rubber compounding. A good average sifting rate for fluffing is 1 lb. per square foot per minute.

Dedusting is the screening operation introduced for the removal of fines. This operation may be done to furnish clean material to a customer or to supply uniform material to machines, such as tablet forming presses which operate on a volumetric basis. Dedusting is usually a slow, low-capacity operation because it is necessary to shake the dust free from the larger particles without subjecting the mass of the material to violent action which might generate more dust. Actual screening tests are usually necessary to determine the permissible rate of feed for successful dedusting.

Instead of Filters

Dewatering is the general name given to operations where screens are used to separate a liquid, which may or may not be water, from a solid. Thus, it includes the removal of TNT crystals from the mother liquor, the separation of synthetic rubber particles or curds from the reactor solutions, the draining of liquid from plant wastes, and the removal of water from coal

This is the first time that a simple method has been presented for the approximate determination of vibrating screen costs. After the needed area has been estimated from actual tests or comparable known data, this article permits estimation of the screen, its drive, its screen cloth, and the cost of making up the cloth into fabricated decks.

sludge. Where a screen is used having a motion which will convey the solids from the feed to the discharge end, preferably in an uphill direction, it is possible to combine spray washing with the removal of the mother liquor and extremely clean solid concentrates can be obtained. Screens which deliver the solids downhill should be avoided for dewatering work as the separated liquid has a tendency to flow down the under side of the screen cloth and work through and join the solid concentrate at the bottom of the screen panel. As an example of dewatering, ordinary plant waste waters containing up to 3 percent solids are dewatered at the rate of 40 g.p.m. per square foot through a 40-mesh screen. Sludge coal can be dewatered at the rate of 17 lb. per square foot per minute on 26 mesh.

Dry Product Sizing

Dry sizing, which constituted the original application of vibrating screens in the chemical industry, is still one of the most active screening divisions. The chemical engineer is primarily interested in separations ranging from 4 to 100 mesh. However, in certain industries separations are made as fine as 325 mesh while, in the raw material fields, grading is done on meshes as large as 2 or 3 in. width and length. Dry sizing often requires the efficient removal of over-size and under-size particles from a material which is to be marketed under rigid specifications, or the clean grading of the material into several definite mesh specifications. Screen capacities naturally drop, the more rigid the specifications. Dry sizing capacities vary greatly according to the substance itself and to the percentage of near-size material in the feed. Typical examples are the screening of fluorescent lamp powder through 100-mesh cloth at the rate of 160 lb. per square foot per hour; corn sugar through 100-mesh cloth at the rate of 60 lb. per square foot per hour; aspirin powder through 28 mesh at the rate of 120 lb. per square foot per hour; and a metallic carbide, which requires very close grading, through 325 mesh at the rate of 3 oz. per square foot per minute.

Wet sizing was originally confined to the sand and gravel industry where the water was used as an aid in washing off the fine sand and clay particles. During the last few years, it has become important as a means of refining liquid materials, and is now applied to such different products as cottonseed oil, synthetic latex, tomato juice and tomato ketchup. Wet sizing may be considered as a form of continuous filtering in which oversize solids are removed and the correct size solids allowed to pass through with the liquid. Wet-sizing screening rates vary over a wide range, examples being the screening of artificial latex through 80 mesh at the rate of 3 g.p.m. per square foot, and tomato juice through 6 mesh at the rate of 8 g.p.m. per square foot.

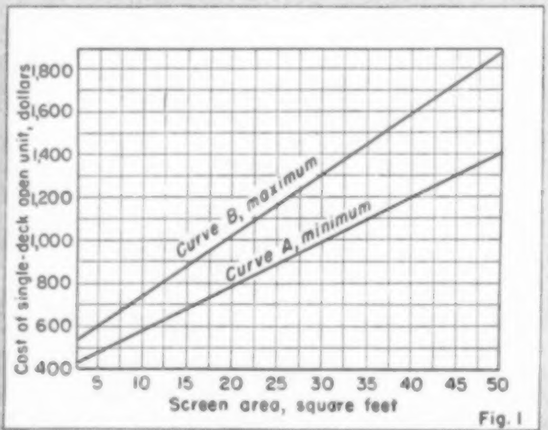
In estimating screen costs, it is first necessary to determine the number of

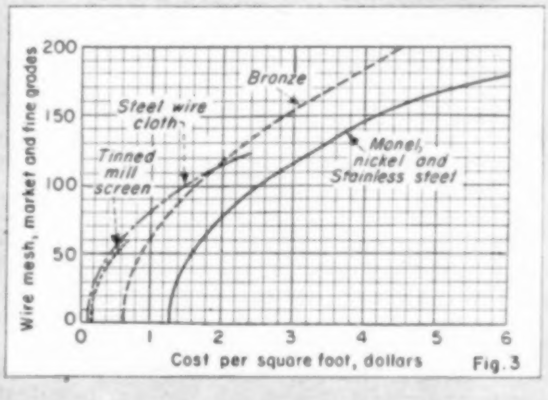
Fig. 1—Basic cost curves for vibrating screens of single-deck open construction (see text for definitions and data on estimating other types)

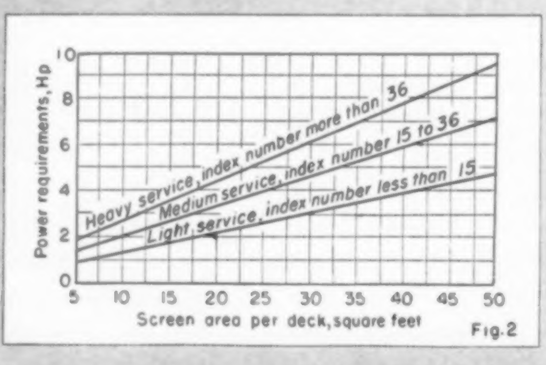
Fig. 2—Power requirements for vibrating screens with rotating drive (see text for determination of "index numbers")

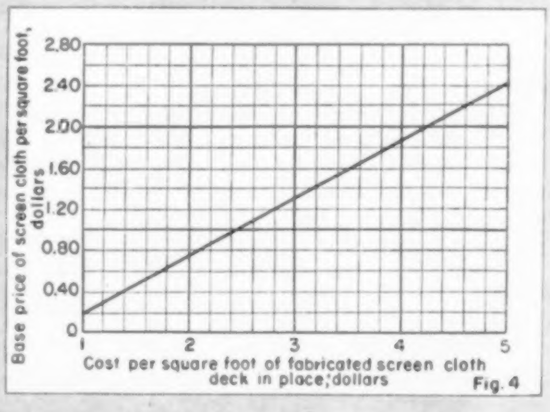
Fig. 3—Average costs of screen cloth of various meshes and metals

Fig. 4—Average costs of fabricated screen decks in place









square feet of screening area which will be required. This is best done by running an actual test on the material, but it may be fairly closely estimated from screening data on similar materials, from records of other mesh separations of the same material, or from consultations with screen manufacturers. If plant-scale screening rates must be estimated without tests, a careful screen analysis of the material should be made to determine the percentage of material going through each screen and the amount of near-size material present which will slow down screening rate.

Figuring the Cost

After the number of square feet of screening area has been determined, reference should be made to Fig. 1. On this chart we find two curves, the lower curve *A* being the cost curve for the most simple, single-deck screen in open construction; and the upper curve *B* being the cost curve for a single-deck screen of open construction embodying the most complete refinements of adjustable slope, adjustable stroke, demountable screen decks and all-metal construction. Knowing the number of square feet of screening area required, the minimum possible cost is read from curve *A* and the maximum cost from curve *B*. Standard screens are available within the price range indicated by these two curves and one must determine the cost figure to use from a knowledge of the degree of refinement which will be required for the particular job. The following points may be of aid in making a price selection. Rough scalping and dewatering can usually be accomplished on open units of fairly simple construction. Wet sizing can generally be done on open units, but the construction must be water-tight and the screen must have a motion which will convey the solids along the screen surface to the discharge. Some fluid materials splash badly when subjected to intense vibration and require an inclosed screen for this reason. Dedusting, fluffing and dry sizing usually require dust-tight construction. Where the same material is to be processed day after day, so that frequent cleaning is not required, and if the material is not subject to rancidity or decay, ordinary construction may be used; but, where frequent cleaning between runs is necessary or where sensitive organic materials are being handled, the interior of the unit should be smooth, preferably with tubular cross members and filleted joints, and the screen cloths should be easily removed for thorough cleaning.

To the basic cost obtained from Fig. 1 for a single-deck screen of open construction, of the class desired, the cost for additional features may be added as a percentage of basic cost:

1. For two-deck construction add 15 percent.
2. For three-deck construction add 30 percent.
3. For a bottom hopper, complete with discharge port, add 12½ percent.
4. For totally inclosed construction, including bottom hopper with discharge port, add 25 percent.
5. For stainless steel construction, double the final cost determined above for the complete unit in the size, construction and type desired.

Costs derived from Fig. 1 do not include the necessary drive and control, but do include V-belt pulleys for the screen and motor, and connecting V-belting in standard lengths. The cost of the motor and control should be figured from standard cost sheets after the horsepower required for the operation is computed from Fig. 2. On this chart are three curves covering light, medium, and heavy service. The question of which curve to use is decided by an "index number" which may be figured from data determined by the specific application. The index number is the sum of the "factor numbers" listed under the headings *A*, *B*, *C*, *D*, *E*, and *F*:

		Factor Number
A.	Speed less than 1,000 r.p.m. . .	1
	Speed 1,000 to 1,350 r.p.m. . .	4
	Speed higher than 1,350 r.p.m.	8
B.	Slope more than 15 deg. downhill	1
	Slope 0 to 15 deg. downhill. .	4
	Slope uphill	8
C.	Crank drive, horizontal plane	1
	Offset-weight drive	4
	Positive eccentric drive.	8
D.	Single-deck construction.	1
	Double-deck construction. . . .	4
	Triple-deck construction.	8
E.	Open construction.	1
	Bottom hopper only.	4
	Totally inclosed construction.	8
F.	Dry service.	1
	Wet service, crystalline solids	4
	Wet service, fibrous solids. . .	8

Example—Find power required to drive a 30-sq ft. screen at 1,100 r.p.m., uphill, offset-weight drive, triple-deck, open construction, handling wet fibrous solids. From the table, $A=4$, $B=8$, $C=4$, $D=8$, $E=1$, and $F=8$. Their sum is 33, which is the index number. Referring to Fig. 2, it is found that index number 33 lies between 15 and 36 so that the service is covered by the Medium Service curve. The ordinate of the curve corresponding to 30 sq. ft. is 4½ hp., which will be required. A 5-hp. motor should be used.

Screen cloth costs are not included in the costs derived from Fig. 1, as these costs show great variation on the basis of mesh, type of weave, material, percentage of open area, and construction. Costs may be determined by referring to Figs. 3 and 4. Fig. 3 gives the average costs per square foot for the standard mesh ranges of steel, tinned steel, market grade bronze and stainless steel wire cloth. Fig. 4 has been made up so that, knowing the cost per square foot for any particular grade, mesh and material, one can estimate the cost per square foot of a fabricated screen deck in place in a screening unit. These estimates are necessarily rough, but will be found to be fairly accurate in covering cost of cutting for size, binding, edging and shipping. Very fine-mesh screens require reinforcing when used in units 2 ft. wide or wider and when made of Monel, nickel or stainless steel should be figured at $10 to $15 per square foot. Special decks, such as the parallel-bar stainless steel construction manufactured by the Bixby-Zimmer Co., may be figured at $10 per square foot.

Tests Before Purchase

The estimating aids given here will be found of real value during the preliminary stages of pilot-plant or full-scale plant development but, before a final selection of equipment is made, it is recommended that tests be conducted on units suited to the particular requirements. Prices based on the area of screen required are no more accurate than the estimates of the area requirements and, on many separations, units of different design and manufacture will give variations of 170 to 300 percent in capacity per square foot per hour.

Referring again to Fig. 1, while curve *B* accurately indicates the cost of a high-grade screen for areas from 0 to 50 sq. ft., it should not be compared directly with curve *A* on a production basis. It is entirely possible for a screen of 24 sq. ft. area of the quality covered by curve *B* to do the work of a screen of 48 sq. ft. area covered by curve *A*. Screens of greater refinement, which can be adjusted to the particular material being handled, will give greater capacity per square foot per hour and will economize on floor space, power and the amount of screen cloth used per deck.

Consultation with the screen manufacturer, or tests conducted on his equipment, are well worth while, since frequently screens can then be purchased on a guaranteed-performance basis. Consultations are also important in determining probable cost of upkeep, including the repair of the screen mechanism and the cost of screen cloth replacements.

Correction—In the article on cost of centrifugals on p. 121 of our May 1947 issue, the last figure in column *B* of Table II should read 80 instead of 18.

Equipment Cost Estimating Data—II

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This is the concluding installment of Professor Bliss' comprehensive article which was started in our May issue. Taken from the equipment cost chapter of the forthcoming third edition of Tyler's "Chemical Engineering Economics," it considerably extends and brings up to date data originally compiled in 1941 by Professor Bliss. Many basic types of equipment including pipe and valves, heat exchangers, filters, vessels and columns, thickeners and classifiers, evaporators, crystallizers, tanks, vessels, pumps, and motors were dealt with in the May issue.

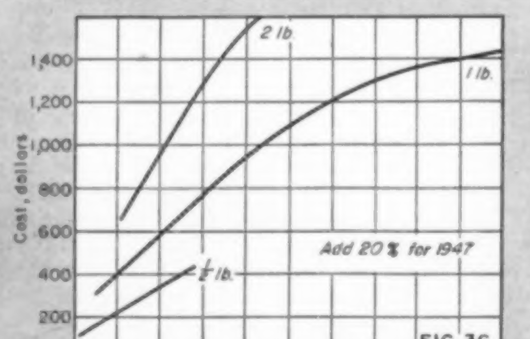
As the first part of this article pointed out, most of the data are based on Fall 1945, since such data are believed to give a better picture of inter-relationships than present costs. But for present estimating, the article gives percentages to be added for 1947 Spring costs.

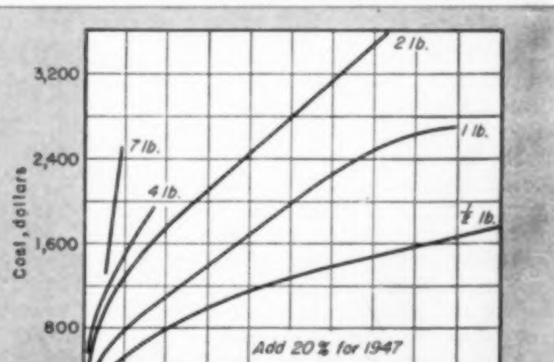
Gas Pumps

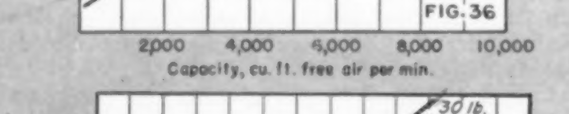
Centrifugal—The cost of centrifugal gas pumps or turbo-blowers is a function of material and type of construction, number of stages, rated capacity, and discharge pressure at rated capacity.

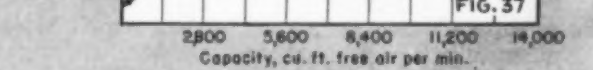
The simplest type is the single-stage, light standard construction turbo-blower, the costs of which are shown in Fig. 36. The cost including motor is shown as a function of rated capacity for several discharge pressures. Standard construction usually

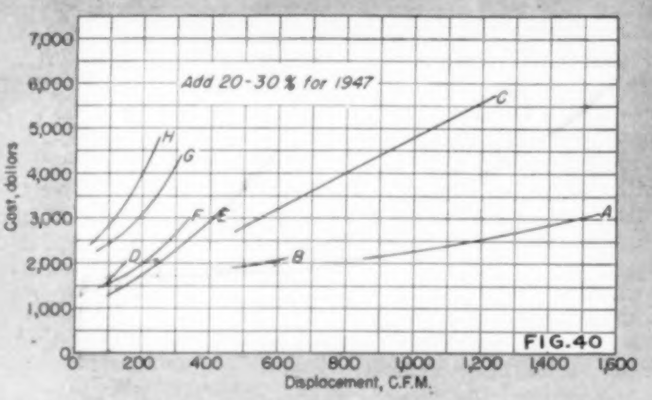
Fig. 36—Costs for single-stage light-duty turbo-blowers
Fig. 37—Costs for multi-stage light-duty turbo-blowers
Fig. 38—Costs for large-size heavy-duty turbo-blowers
Fig. 39—Costs for rotary gas pumps, 15 lb., no motors

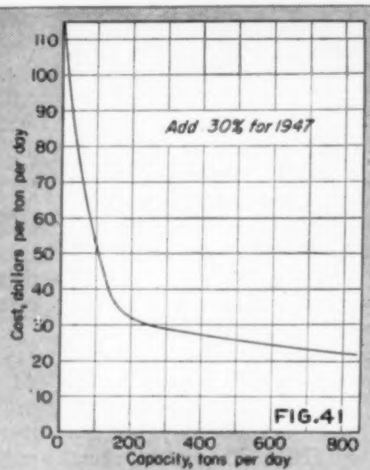


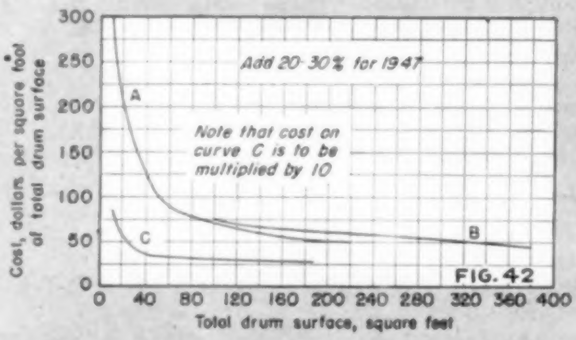












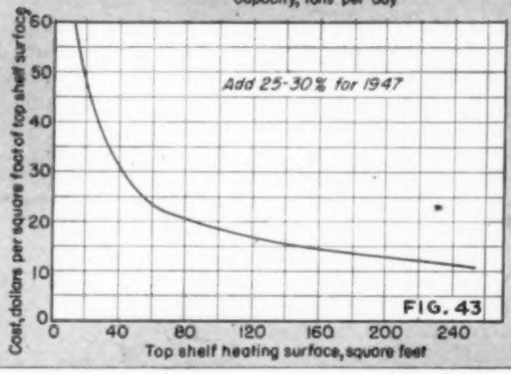


Fig. 40—Costs for double-acting reciprocating compressors

Fig. 41—Costs for ball mills without motor or balls

Fig. 42—Costs for drum dryers with motors and conveyors

Fig. 43—Costs for vacuum shelf dryers less accessories

implies steel casings and aluminum or steel impellers. It is necessary to add about $50 for gas-tight construction if gases other than air are to be handled or if the pump is to be used for recirculation. Casing and impeller of stainless 304, Everdur, or Monel can be supplied at about a 50 percent increase in cost.

Higher pressures and larger capacities require a multi-stage turbo-blower. The costs, including motors, are shown in Fig. 37. The same factor for alternate construction materials applies in this case, but for gas tight construction $50 should be added below 50 hp. and $100 above that.

For very large capacities, higher pressures, and longer life it is necessary to turn to a heavier type of construction, better designed to give higher efficiencies. These have casings of cast iron and impellers of cast aluminum alloy or high-grade steel. The costs of such machines with motors are shown in Fig. 38. No increase is necessary for gas tight construction, and it is impossible to generalize on the effects of alternate construction materials.

Rotary—The cost of rotary pumps for 15-lb. pressure without motors is shown in Fig. 39. As in the case of liquid rotary pumps, the capacity is a function of speed, and as before the maximum recommended speed has been chosen. In Fig. 39 the cost in dollars is plotted against the maximum rated capacity in cubic feet of free air per minute. These data are for sliding-vane type pumps at 15-lb. pressure, although pressures in the range of 5 to 15 lb. can be handled in the same type of pump at negligible change in cost. In the smaller sizes pressures as high as 40 lb. can be handled without significant change in cost. Costs of rotary gas pumps vary among manufacturers because of certain changes in design, but the curve of Fig. 39 represents a reasonable average.

Reciprocating Compressors — The cost of horizontal, double-acting, reciprocating compressors for air, ammonia, or other relatively non-corrosive service as functions of displacement is summarized in Fig. 40. A word of caution is necessary about volumetric efficiency, because of which the delivery volume corrected to inlet conditions will be less than the displacement. These costs are for the bare compressor with intercoolers but without drive or aftercooler.

Curve *A* represents single-stage compressors for 20 to 30-lb. discharge pressure.
Curve *B* represents single-stage compressors for about 100-lb. discharge pressure.
Curve *C* represents two-stage, tandem compressors for about 100-lb. discharge pressure.
Curve *D* represents two-stage, tandem compressors for 400-lb. discharge pressure.
Curve *E* represents two-stage, in-line compressors for about 350-lb. discharge pressure.
Curve F represents the same compressor as *E* except for 500-lb. pressure.
Curve *G* represents three-stage, in-line compressors for about 1,500-lb. discharge pressure.
Curve *H* represents the same compressor as *G* except for 2,500-lb. pressure.

It may be noted that a vertical compressor, when available, is usually cheaper by about 25 percent than the corresponding horizontal one. Four-stage machines for pressures as high as 3,500 to 4,000 lb. are highly specialized, but at a displacement of 180 c.f.m. a cost of $7,500-$8,000 with motor but without aftercooler is reasonable. Reciprocating compressors of small displacement to be used as boosters are so specialized as to be incapable of generalization of this sort.

Crushing and Grinding

Owing to the wide variety of materials which may be subjected to size reduction, there is a large number of equipment types for such operations. As is well known, the type to be chosen is affected by the nature of the material to be handled and the size of such material as well as by other factors. It would be difficult to consider all the various types and

applications, and as a result, only a few suitable for grinding of more common ores of average hardness will be considered.

Jaw Crushers — The cost of jaw crushers may be estimated by determining the size of machine suitable for the duty at hand, and its recommended horsepower. The cost will approximate $100-$115 per hp., based on Spring 1947 figures.

Crushing Rolls—A method similar to that for jaw crushers may be used for two-roll crushing rolls. The cost per horsepower in 1947 is about $140. Single-roll and four-roll crushers may be estimated in the same way, but the former costs about 50 percent more and the latter about 200 percent more than the two-roll type.

Swing-Hammer Mills — The same method will apply, as an approximation at least, for swing-hammer mills, except that the cost per unit horsepower is not constant. Thus with standard machines of this type the cost is about $45 per hp. at 10 hp. and about $30 at 75 hp. With heavy-duty machines of this type the figures are about $55 at 15 hp. and $40 at 300 hp. All figures should be increased about 30 percent for Spring 1947.

Ball Mills—The method outlined above is not satisfactory for ball mills because any particular mill may have a power requirement within fairly wide limits depending on the duty. It is desirable in this case to present the cost as dollars per unit of capacity, the latter expressed as tons per day. Such capacity, of course, depends on the material being ground, manner of grinding, and size range involved. For this correlation the capacity chosen is that of a common ore of medium hardness, being reduced from 1½ in. to 90 percent through 100 mesh, in closed-circuit dry grinding. The cost of ball mills without motors or ball charges is shown as a function of such capacity in Fig. 41. In order to use this figure for cases other than the specific one represented, it would be necessary to pick the mill for the particular case at hand, convert the capacity of that mill to the conditions here considered and determine the cost accordingly. For example, suppose it were necessary to dry grind the same material in open circuit from ½-in. size to 10 mesh at 120 tons per day. According to the "Chemical Engineers' Handbook"[4] this duty would require the same mill as would be required for 360 tons per day with the conditions presented in the figure. The cost would therefore be $360 \times \$28 = \$10{,}100$, plus 30 percent for Spring of 1947.

Dryers

Dryers are for the most part specially designed and built to order so that cost generalizations are somewhat difficult to make. It is possible to do so, however, for a few standard types of the most common design. Those here discussed are largely of iron construction, and the use of other materials would require consultation with manufacturers.

Drum Dryers—The cost of steam-heated drum dryers is shown in Fig. 42. Curve A is for atmospheric single-drum, Curve *B* is for atmospheric double-drum, and Curve C (note that ordinate is to be multiplied by 10) is for vacuum single-drum dryers. These costs include motors and feed conveyors for the atmospheric types and motors and receivers for the vacuum type.

Vacuum Shelf Dryers—The cost of steam-heated dryers of this type without accessories is shown in Fig. 43.

Vacuum Rotary Dryers—The cost of steam-heated rotary vacuum dryers varies from about $60 per sq.ft. at 100 sq.ft. to about $25 at 600 sq.ft. Such figures include vacuum pump and condensers. Add about 35-45 percent for Spring of 1947.

Atmospheric Rotary Dryers—The cost per sq.ft. of peripheral area of three variations on this type of dryer may be estimated as follows. About 25 percent should be added for 1947.

	At 200 Sq Ft.	At 1,200 Sq. Ft.
Flue gas heated, direct-indirect	$28	$25
Flue gas heated	24	16
Hot air heated, direct	20	14

Such costs include motors, cyclones, and heating equipment but exclude insulation, piping and ducts, and erection. Labor cost of erection of rotary dryers approximates 15 percent of the dryer cost.

A PROCESS EQUIPMENT COST ARTICLE

Standardizing Cost Data on Process Equipment

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Lack of published information on costs of chemical equipment needs no proof, and only driblets have been printed in the past few years. Although these more recent, previously published data are interesting and valuable, many of them fail to fulfill their function. Primarily this is because the data in one article are not comparable with those in the next.

Published equipment cost information is seldom, if ever, used for the final firm construction estimates that managements require before making appropriations. For these estimates actual quotations can be and are obtained since the estimate is based on a complete design and equipment has been fully specified. Published cost ranges and curves for equipment are used primarily by those who make order-of-magnitude economic analyses, particularly those made during research on new processes or products. The publishers of cost information should aim their data at these users.

The major failing of the equipment cost information that is now available in the literature is that it is not on a consistent basis. It is not consistent as to price and wage levels which may vary widely from year to year (and today, from month to month); it is not consistent as to inclusion of necessary accessories such as starters for motors, or heaters and cyclones for rotary dryers; it is not consistent in including or excluding installation cost; and finally it is not consistent in including or excluding construction overhead. It appears that the chemical publications and the entire chemical industry should agree on some common ground for the presentation of such data.

Consistent Correlations

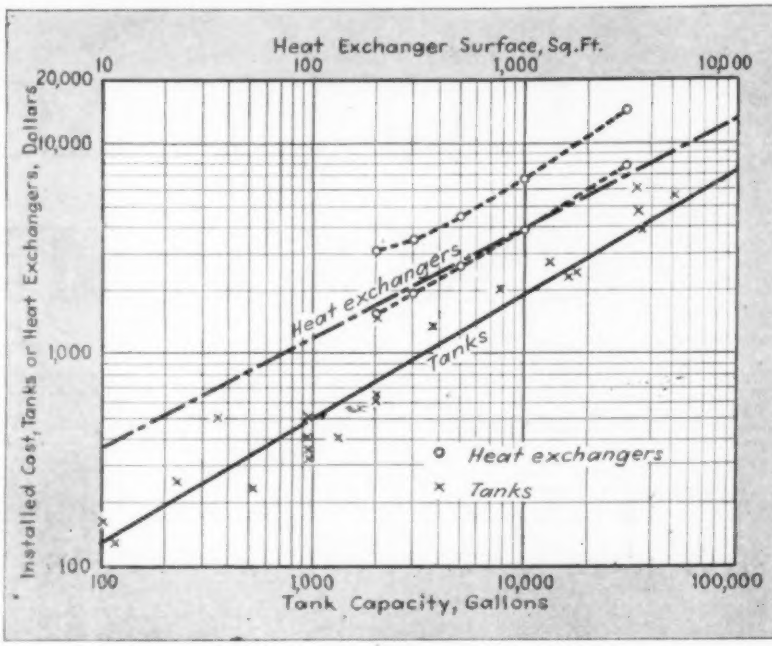
The economic analyst who uses equipment cost data daily is at a loss if he does not correlate the information he collects on some consistent basis, or at the very least he needlessly

complicates his job. This correlation is not difficult and merely means the choice and use of one basis. In general that basis should be picked so that the resultant information is most useful in building up plant investment estimates. As his basis the writer has chosen the following:

1. All figures include cost of construction and construction overhead as well as the purchase price of the unit.

2. All figures have been revised to a reference construction cost index. The writer uses a modification of the index published in *Engineering News-Record* and has chosen 150 (ca. January 1945) on that index as his constant value.

3. All figures include accessories. For example all pump costs include drive, starter, wiring, foundation, and so forth. In addition they include insulation, painting, and similar necessary work.



Installed cost data for mild-steel tanks (lower curve); and for heat exchangers, including condensers and calandrias (upper dot-dash curve). For comparison the dotted lines indicate heat exchanger data of Happel *et al*, approximately revised to the author's basis, the two lines being maxima and minima

Ranges Not Wanted

As enough data are collected curves are drawn for the cost of each type of equipment and it is these curves that are used in building up plant investment estimates. These curves are only accurate to within plus or minus 10 or 20 percent but they provide *a* figure, and the estimator has to pick one figure, not a range, when he is working up a plant cost. As an example, the lower, solid line on the accompanying chart shows the curve derived for low-pressure, mild-steel tanks. The plotted points have been revised to the above basis and include foundations and other accessories. No differentiation has been made between upright and horizontal tanks, or other small modifications. The correlation is reasonably good and the plotted line is adequate for analytical estimates. It is interesting to note that the plotted line closely follows the old rule-of-thumb six-tenths factor, the equation derived from the plotted points being $y = 8.36\ x^{0.594}$. For those not familiar with the factor, it is used as follows: If a cost is known at one capacity and the cost is desired at a second capacity x times the first, multiply the initial cost by $x^{0.6}$ to obtain the second cost.

As a second example, the upper dot-dash line in the chart shows a cost curve for mild-steel heat exchangers in which cost is plotted against square feet of heat exchange surface. Heat exchange area is used as a basis for capacity since it usually can be calculated readily from flow sheet data. Again the costs are for installed equipment and include overhead, supports, foundations, connections, and so forth.

Also plotted, as dotted curves, are the data of Happel *et al*[1] revised to the writer's basis. This was done by adding to Happel's heat exchanger costs the percentages given in his article for installation labor, foundations, structural steel, insulation, fire protection, painting, indirect construction expense, and contractor's fee. It will be noted that there is good agreement between the writer's data and the adjusted minimum published figures. It is seldom, however, that enough data are presented to make such comparisons as this possible. For example Bliss[2] gave no installation cost data and the data of Millet[3] are based on B.t.u. per hour per dollar of selling price.

Curves Plus Percentages

Once curves of this type have been developed for most unit process equipment, the estimation of plant cost is relatively easy. Costs of the major pieces of equipment (the accessories do not need to be calculated in detail) are taken from the curves, totaled, and adjusted to today's construction cost. Percentages can then be added for piping, instruments, buildings (sometimes estimated in more detail), outside lines, and service equipment (e.g., hoists, furniture, safety equipment, etc.). Adding these and a percentage for contingencies, the plant cost estimate is completed. As pointed out by Eckhardt[4], it is surprising how close such rough estimates can come to actual plant costs.

The basis chosen by the writer is shown purely as an example. The basis can be the purchase cost of the pieces of equipment, as Happel *et al*[1] have chosen. In this case data on accessories as a percentage must also be accumulated. If this basis is used, all costs except the equipment purchase cost can be, and usually are, added by factor. This method is widely used but appears unduly detailed.

Going on From There

The writer makes no claim that the basis he has chosen is the best, and he would like to see better ones proposed. But the necessity for choosing, and adhering to, one basis is obvious and that choice should be made soon. It appears equally obvious that the chemical and chemical engineering journals and technical society publications should agree on a common basis since it is in these publications that future cost data will appear. The basis described here is suggested with this need in view.

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FATTY ACID PROCESSING

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TWO AUTHORITIES REPORT ON THE TECHNOLOGICAL ADVANCES THAT HAVE KEPT AN OLD INDUSTRY IN STEP WITH THE TIMES

FATTY acids are playing an increasingly important role in the nation's chemical economy, as shown in Table I, and production figures have climbed steadily. Recent indications are that proposed new constructions should materially increase our fatty acid supply, which at the present time is still insufficient to meet demands. Additional interest in fatty oils and acids is indicated by new process developments in the industry, such as continuous fat-splitting, fatty acid distillation, and solvent extraction and crystallization of fatty oils and acids. Table II indicates the most recent figures on production. Production may be divided into two main classes, synthetic fatty acids and natural fatty acids, of which the latter at present are by far the more important.

Synthetic

The production of synthetic fatty acids has been a possibility which has intrigued chemists and chemical engineers for many years. The obvious method of manufacture is air oxidation of long chained hydrocarbons, such as occur in petroleum. Although much research has been expended on this general subject, the great stumbling block remains the problem of the separation of the heterogeneous mixture which is obtained.

Germany has in the past been the only commercial user of such a process. Production of fatty acids by such a method in Germany has recently been estimated to have totalled 100,000 tons per year.[4] The mixture of hydrocarbons used as raw material was obtained either by coal hydrogenation (Bergius process) or by hydrogenation of CO (Fischer-Tropsch process). Often the selected paraffin stock is subjected to an oxidizing pretreatment with powdered $KMnO_4$ to initiate the formation of peroxides, which accelerate the subsequent air oxidation. This air oxidation is carried out in special towers, by an air blow treatment, with a manganese soap catalyst.[B]

The resulting acids could then be separated by careful rectification; many varied uses were developed for the individual fractions. In fact, the C_9-C_{16} fraction, after treatment, could be converted into an excellent edible fat.[4] In addition, any of these fractions could be reduced to the corresponding alcohols if desired.

Mention may also be made of a recent study made on production of organic acids by direct oxidation of coal.[10, 18]

One very new and important development in this country is the opportunity revealed in the new Synthine, or Fischer-Tropsch process. This process, which utilizes a mixture of CO and H_2 (obtained by direct oxidation of natural gas) to produce hydrocarbons, yields approximately 25 percent of oxygenated materials as byproducts. These byproducts include substantial amounts of organic acids, including butyric, valeric and caproic acid in order of decreasing quantities.[8] It is as yet too early to predict what effect these acids will have on the over-all picture.

Natural

The most important method of hydrolyzing the glyceride molecule is by the use of sodium hydroxide, which reaction is carried out in the familiar soap kettle. Naturally this gives the sodium salt of the acid, and an acidification step would then be necessary to free the fatty acid. Such an acidification is actually carried out to produce acids from "foots," or stock resulting from alkali refining of oils.

In this country, at the present time, most of the commercial fatty acids are obtained by the "splitting," or hy-

The commercial uses of fatty acids are many and varied. The future of the industry looks extremely promising, as evidenced by the entrance of a number of new companies into the field. New processes and improvements in existing processes are being continually developed. In addition to the older uses of the acids, the field of new chemical derivatives of fatty acids holds much interest. Also, developments in the field of synthetic fatty acids promise much for future research.

Table I—Industrial Uses for Fatty Acids*

Cosmetic Industry

Cold creams, emollient creams, shaving creams and soaps, shampoos, deodorants, lotions, toilet soaps, face and body powders.

Chemical Derivatives

Fatty acid esters (such as glycerine monostearate, ethylene glycol monostearate); †Metallic stearates (aluminum, zinc, calcium, magnesium, lithium); Fatty acid amines, amides, nitriles.†

Detergency

Household soaps (bar and powder), water-proofing agents, detergents (when chemically modified).

Leather Industry

Shoe polishes, saddle soaps, leather dressings, finishes and penetrants.

Metal Industries

Ore flotation agents, soldering fluxes, cutting oils, rust preventatives, abrasive and buffing compounds, wire drawing compounds, metal polishes.

Paints, Resins and Inks

Alkyd resins (with phthalic anhydride), drying oils (esterified), pigment dispersers, metallic powder lubricants, plasticizers (esterified), flatting agents, plastics mold lubricants, asphalt emulsifiers.

Petroleum

Lubricating greases, lube oil additives.

Pharmaceuticals

Emulsifiers, germicidal soaps.

Rubber

Rubber additives, plasticizers, rubber compounding, synthetic rubber emulsifying agents.

Textiles

Water-proofing agents, fungus-proofing agents, penetrants, textile finishes, softeners, oils.

Miscellaneous

Paper coatings and defoamers (in paper mfg.), polishes (floor, automobile and furniture), carbon paper, mimeograph stencils, typewriter ribbons, thickeners, candles, crayons, wax matches, recording disks, sealing compounds, cement water-proofing agents.

* Either as the free acids or derivatives. † These products have many individual special uses of their own, not mentioned here.

drolysis, of naturally occurring fats and oils without the use of alkali.

$$\begin{array}{l} CH_2OCOR \\ | \\ CHOCOR' + 3HOH \\ | \\ CH_2OCOR'' \end{array} \longrightarrow \begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array} \begin{array}{l} RCO_2H \\ \\ +R'CO_2H \\ \\ R''CO_2H \end{array}$$

The important general methods for accomplishing this splitting are the Twitchell and autoclave process (both of which are batch) and the continuous splitting process. A tabular comparison of various splitting processes is depicted in Table III, showing advantages and disadvantages of each.

Batch Processes

The Twitchell process is the simplest method of fat splitting. The operation is carried out in tanks, where the acid-washed fat is mixed with 25-50 percent water, and 0.75-1.25 percent of catalyst. Hydrolysis is accomplished by boiling with open steam for 20-48 hr. Considerable amounts of albuminous material and other impurities present in poorer stocks usually necessitate preliminary acid refining with strong sulphuric acid. The splitting is carried out in from two to four stages, the "sweet water" (glycerine solution) being withdrawn at the end of each stage and replaced with fresh water or weaker sweet water from a previous boil.[1]

High-pressure autoclave splitting is the oldest non-alkaline commercial process.[20] Autoclaves are about 4-6 ft. in diameter and 20-40 ft. high. After charging with fat, catalyst, and 30-60 percent water, steam is admitted to reach the desired pressure. Upon splitting, the contents are blown to a separating tank, where the fatty acids are drawn off from the sweet water. The catalyst must be removed by acid treatment.[1]

Autoclave fat splitting without catalyst is not used widely. A stainless steel autoclave with mechanical agitation gives rapid splitting at 450 deg. F. with the production of light colored fatty acids, and a pure glycerine solution, providing a good grade of raw stock is used.

Continuous Splitting

The process which bids fair to dominate future developments in this field is continuous, countercurrent high pressure, high temperature splitting. The concept of continuous hydrolysis is by no means a new one; however, commercial development was not forthcoming until high pressure equipment of acid resistant stainless steel alloys became easily available.

Present commercial processes are based on the work of Dr. Martin H. Ittner of the Colgate-Palmolive-Peet Co.[18] and Dr. Victor Mills of the Procter and Gamble Co.[25]

A simplified flowsheet for the Colgate process is shown in Fig. 1. The "P & G" process was described in an article flowsheet in *Chem. & Met.'s* April issue.[23]

Fatty oil is passed through a vacuum deaerator (to prevent darkening by oxidation during processing) and then fed at a controlled rate to the bottom of the hydrolyzing tower, built of stainless steel Type 316 (see Fig. 2). Here the oil contacts the aqueous glycerine leaving the column and, rising because of its lower density, extracts the small amount of fatty material dissolved in the aqueous phase. At the same time deaerated and, in hard-water areas, demineralized water is fed to the top of the tower where it flows down over trays in contact with the upward flowing split acids and extracts from them the glycerine dissolved in the fatty phase. After leaving the contacting sections of the tower, the two streams are brought to reaction temperature by direct injection of high pressure steam; they then enter the main reaction zone where the final phases of the splitting occur. Mention should be made that this process may be operated catalytically, the usual catalysts being zinc, magnesium or calcium oxides.[18] Naturally, during the process the actual catalysts would then be the fatty acid soaps of the corresponding heavy metal.

The fatty acids, upon discharge from the top of the tower, flow to a decanter where the water still suspended in them is separated. An interfacial level controller in the splitting column maintains the position of the interface between the fatty phase and the aqueous phase by regulating the discharge of the aqueous glycerine to the glycerine storage tank.

To indicate splitting performance, with a feed stock similar to the Eastern Classification of Good Common Tallow and an oil to water ratio of about 1.4 to 1, the tower will normally operate at 485 deg. F. and 700 p.s.i. gage to hydrolyze 98 percent of the glycerides to fatty acids and yield a 15 percent dilute glycerine solution.[6] Feed

Table II—Factory Production of Fatty Acids and Stocks (Thousands of Pounds) *

	1945	1946
Vegetable and animal foots,† 100% fatty acid content...	213,476	225,911
Other fatty acid stock, including spent and salvaged oils and fats, tall oil, palm oil, refuse, etc.	177,850	171,982
Vegetable oil fatty acids from foots and other than from foots, including fatty acids from tall oil, palm oil, refuse, etc.	202,346	191,878
Fish and marine mammal fatty acids	34,795	33,421
Animal fat and oil fatty acids	221,043	245,564
Red oil (oleic acid)	74,139	81,944
Stearic acid	54,207	64,073

* Department of Commerce, Bureau of the Census Report on Fats and Oils. † Production Figures on Foots from Fish and Marine Mammal Oil not included.

stocks other than tallow may be handled equally successfully with a high yield of fatty acid, although modifications may be necessary for more heat-labile oils as linseed or fish oils.

Mention should also be made of the Eisenlohr Process,[8, 19] in which the flow of oil and water is concurrent rather than countercurrent. Oil and water are emulsified and passed into reaction coils where splitting is rapidly accomplished at 600 deg. F. and 3,500 p.s.i. (see Table I). The reaction mixture of water, glycerine, and fatty acids is released into a flash chamber, where a substantial part of the water evaporates. The remaining mixture is cooled and settled to afford separation of fatty acids from the 35 percent glycerine solution.

Purification After Splitting

In most cases, it is desirable to purify the acids following the splitting, although this choice depends on the original quality of the raw stock and the use intended for the fatty acids. The usual method of purification is vacuum distillation of the acids, although recent developments indicate that solvent extraction may also give the desired purification.[3]

Vacuum distillation is usually carried out with the aid of stripping steam. This step allows the distillation to proceed at a lower temperature but requires the use of larger equipment in order to avoid excessive pressure drop through the condensing system, as compared to an equivalent amount of fatty acid distilled without steam. The ordinary distilling temperature is from 450-500 deg. F., with maximum permissible temperature depending principally on the degree of unsaturation of the acids; a highly unsaturated stock (as linseed oil fatty acids) undergoes excessive polymerization at higher temperatures. Another factor to be considered in distillation is the extreme corrosiveness of hot fatty acids, which necessitates the use of special high-chrome-nickel stainless steel such as Type 347 for equipment construction.

The older type of fatty acid batch still consists of a direct fired pot, with the accompanying condensers and vacuum pumps. Such a still gives little or no rectification. The high surface temperatures and prolonged heating times involved give appreciable quantities of still bottoms or pitch residue caused by polymerization, oxidation and decomposition. Open flame heating is avoided in modern batch stills by the use of steam or Dowtherm jackets or coils as heating media; Dowtherm is preferred because of the lower pressures involved.

Modern large scale operation uses continuous stills rather than batch; stills such as these are used in the Colgate continuous hydrolysis process, as an auxiliary for fatty acid purification following splitting.[8, 21] Dehydrated fatty acids are pumped through a Dowtherm-heated preheater which serves both to preheat and partly vaporize the incoming feed on its way to a cyclone type flash chamber. Upon entering the cyclone flash chamber, undistilled liquid, consisting largely of polymerized material and other impurities, is thrown outwardly to the walls from which it flows downward to a bottoms receiver while the fatty acid vapors flow out of the top of the cyclone flash chamber to primary and secondary condensers. The non-condensable gases are removed by a three-stage steam ejector.[21]

New techniques now used by industry for fatty acid fractionation may be divided into two main classes, that is, separation of fatty acids of different chain length by rectification and separation of fatty acids of different degrees of unsaturation by solvent extraction or crystallization.

The ordinary fatty acid distillation is merely a method of purification; it accomplishes little separation of individual components. However, relatively pure fatty acids may be obtained by vacuum rectification in a commercial tray-type fractionating tower (see Fig. 3). Although it is not possible to separate by rectification the fatty acids having like-numbered carbon atom chains, as, for example, stearic acid from oleic acid, fairly good separation of different length chains is obtained, as palmitic acid from stearic acid.

A brief description of fatty acid rectification is here presented, based on

Table III—Tabular Comparison of the Various Splitting Processes

	Twitchell Process	Batch Autoclave		Continuous Countercurrent	Continuous Concurrent
Temperature, deg. F.	212–220	300–350	450	485 approx.	600
Pressure, p.s.i. gage	0	75–150	425–450	700	3500
Catalyst	Alkyl-aryl sulphonic acids or cycloaliphatic sulphonic acids, both used with sulphuric acid 0.75–1.25 percent of the charge	Zinc, calcium, or magnesium oxides, 1–2 percent	No catalyst	Optional	None
Time, hr.	20–48	5–10		2–3	0.33
Operation	Batch	Batch		Continuous	Continuous
Equipment	Lead-lined, copper-lined, monel-lined or wooden tanks	Copper or stainless steel autoclave		Type 316 stainless tower	Inconel or stainless steel
Percent Hydrolyzed	85–98 percent hydrolized, 5–15 percent glycerol solution obtained depending on number of stages	85–98 percent hydrolysed, 10 to 15 percent glycerol depending on number of stages		97–99 percent, 10–25 percent glycerol	85–90 percent hydrolyzed
Advantages	Low temperature and pressure; adaptable to small scale; low first cost because of relatively simple and inexpensive equipment.	Adaptable to small scale; lower first cost for small scale than continuous process; faster than Twitchell.		Small floor space, uniform product quality; high yield of acids; high glycerol concentration; low labor cost; more accurate and automatic control; constant utility load.	Uniform product quality; low labor cost; accurate and automatic control; constant utility load.
Disadvantages	Catalyst handling; long reaction time; fat stocks of poor quality must often be acid-refined to avoid catalyst poisoning; high steam consumption; tendency to form dark colored acids; need more than one stage for good yield and high glycerol concentration; not adaptable to automatic control; high labor cost.	High first cost; catalyst handling; longer reaction time than continuous processes; not as adaptable to automatic control as continuous; high labor cost; need more than one stage for good yield and high glycerol concentration.		High first cost; high temperature and pressure; greater operating skill.	High initial cost; very high temperature and pressure; greater operating skill; lower capacity than countercurrent; much lower percent split and glycerol concentration than countercurrent.

modern technology.[26, 27] Three fractionating towers are provided, of the conventional tray type. Steam is used in the columns to insure stripping of the light fractions and to reduce the necessary fatty acid vapor pressure. The first or topping tower receives the preheated charge stock of crude fatty acid and produces a light overhead fraction usually containing a concentration of odor and color-bearing constituents, some of which is returned to the tower as reflux. The main product, or bottoms, from the first still then passes on to the second, or pitch still, which effects a vaporization of all but the pitch or bottoms, which, however, represents a salable product. The liquid condensate passes on to the third or main fractionating tower, where an overhead fraction and a bottom fraction are obtained, representing the second and third acid fractions. All three columns operate under vacuum (a four stage air ejector with barometric inter and after condensers maintains an absolute pressure of 2 mm. Hg at the condenser outlet). Heating is provided by an oil-fired Dowtherm vaporizer.

Fatty acids obtained by this process have a limited purity, as shown by a typical approximate analysis of a commercial palmitic acid[1]: 90 percent palmitic acid, 6 percent stearic acid, 4 percent oleic acid.

The fatty acids may be sold as such, or they may be converted by chemical reaction into a host of interesting new chemicals. Fatty acid derivatives may be roughly divided into two types, the first of these being prepared by a modification of the hydrocarbon chain. For example, oleic acid on oxidation yields dihydroxy stearic acid, which can be further oxidized to yield a mixture of pelargonic and azelaic acids. Too, hydrogenation of double bonds would fall in this class. Also, ricinoleic acid (12-hydroxy-9-octadecanoic acid) can be dehydrated to give a mixture of 9-11- and 9-12-linoleic acids.

The second type of fatty acid derivative is that prepared by a chemical reaction of the carboxyl group. This method of attack can yield many new compounds which have important industrial uses. As an example, consider the formation of fatty acid amides, amines and nitriles.[28]

$$RCO_2H \xrightarrow[\text{High temp.}]{NH_3} RCONH_2 + H_2O \quad \text{Amide}$$
$$2RCONH_2 \rightleftharpoons RCO_2NH_4 + RCN \quad \text{Nitrile}$$
$$RCN \longrightarrow RCH_2NH_2 \quad \text{Amine}$$

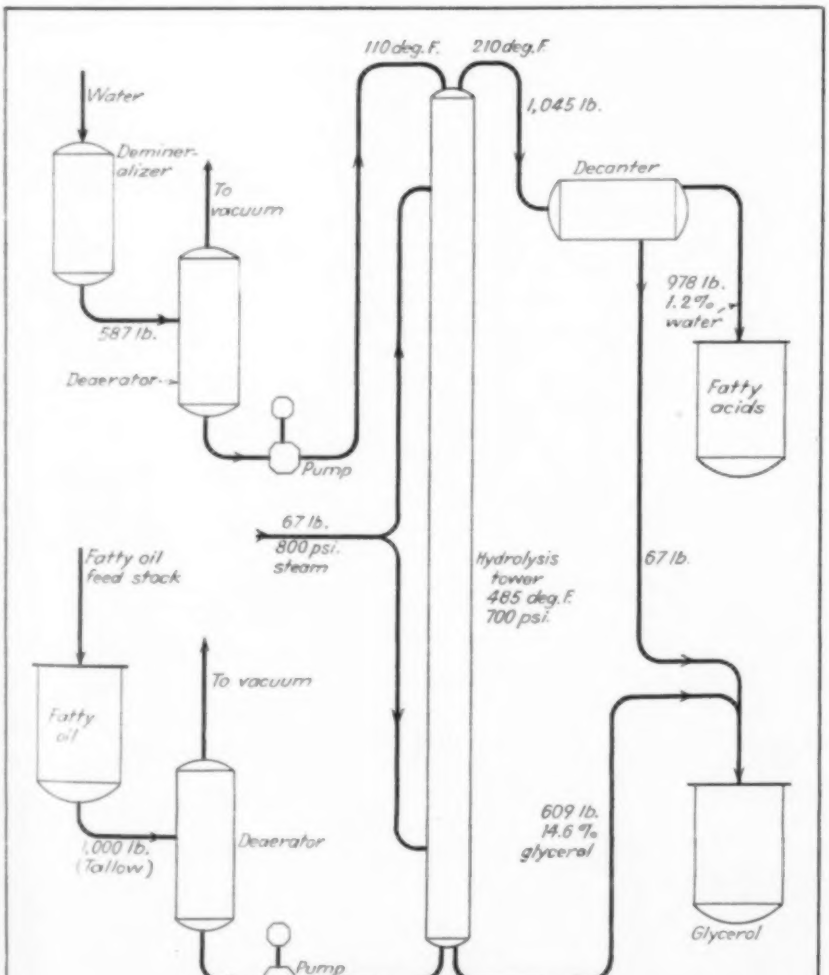
The nitriles find use as plasticizers and insect repellants. They can be thermally cracked to yield saturated and unsaturated shorter chain nitriles and hydrocarbons, from which a wide variety of aliphatic compounds can be easily prepared. (It may be said here that Armour and Co. has been one of the foremost leaders in the development of pure fatty acids and their chemical derivatives.)

Mention has been made of the fact that the rectification process will not separate fatty acids whose only structural difference is a double bond, as stearic from oleic, or oleic from linoleic. In the past such a separation has been performed commercially by a process based on the difference in melting points of fatty acids at room temperature, the saturated acids above C_{16} remaining as solids. Such a process is exemplified in the commercial production of stearic and oleic acids, carried out by chilling the fatty acids (which were obtained by the splitting process) and subjecting the resulting cakes to mechanical pressure to express the liquid acids. Best engineering practice is achieved when the composition of the solid acid constituents are kept at a level of approximately 45 percent stearic and 55 percent palmitic acid; consequently the solid mixture of this approximate composition has been known in the trade as commercial stearic acid.

The mixture of distilled fatty acids from the fat splitting operation is cascaded into flat aluminum pans, about 2 ft. x 1 ft. x 2 in., and chilled slowly to 36 deg. F. The solidified fatty acid cakes are removed from the pans, wrapped in burlap, and stacked in hydraulic presses where the initial pressing takes place. To remove residual liquid fatty acids still remaining in the cakes, they are remelted, recast, and repressed in successive hot pressing operations at temperatures around 100 deg. F. The total number of pressings indicates the purity of the solid product, hence the terms single-pressed, double-pressed and triple-pressed commercial stearic acids.[7] The oleic acid content of the stearic acids varies from 3 to 17 percent.

The liquid acids separated during the cold pressing constitute the red oil

Fig. 1—Flowsheet of Colgate continuous countercurrent hydrolysis process



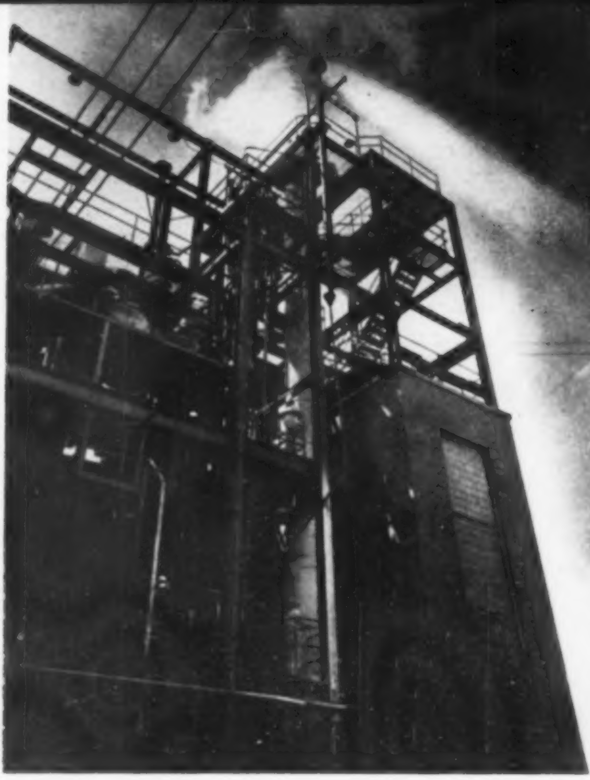


Fig. 2—P&G's continuous hydrolyzing tower

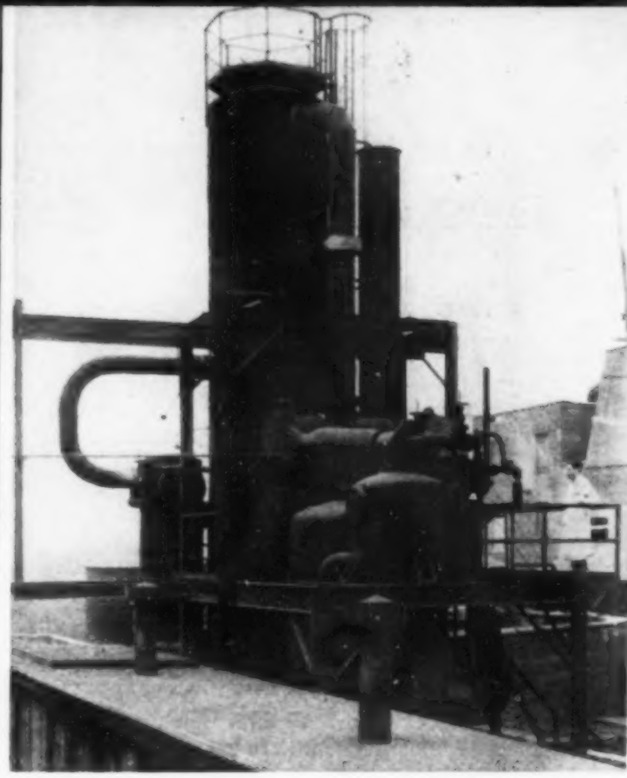


Fig. 3—Fatty acid vacuum fractionation tower

(oleic acid) of industry but must be purified by distillation if a better grade of acid is desired. The expressed fraction of the subsequent hot pressings contains large quantities of solid acids in solution, and must be recycled, an obvious disadvantage from an engineering viewpoint.

Newer, continuous, more efficient and more flexible processes have been developed, based on fractional crystallization of acids from a polar solvent. One process utilizes an acetone-water mixture. Another, the "Emersol" process (Emery Industries, Cincinnati), uses a 90-10 percent mixture of methanol and water. In actual operation of the latter, the distilled fatty acid mixture is dissolved in methanol solution, along with a small amount of glyceride as a crystal promoter, and chilled in a multi-tubular agitated crystallizer, crystallizing the stearic acid. By proper choice of solvent and crystal promoter, granular needle-like crystals, having good filtering and washing characteristics will be formed.

This "Emersol" slurry is separated on a continuous rotary vacuum filter, and the cake washed with fresh solvent to remove adhering liquid acids. The filter cake, containing 30-60 percent solvent, is melted and charged to a still for solvent recovery. The oleic acid solution from the filter is similarly stripped of solvent. All equipment is of aluminum or stainless steel Type 316. Operating costs for the process are said to be 65 percent less than for mechanical pressing. In addition, the process is extremely flexible, both with regard to raw materials and products.[3, 7, 14]

A slightly different approach to the problem is the use of the non-polar solvent propane in a solvent-extraction and crystallization process known as the Solexol process (M. W. Kellog, Jersey City, N. J.). This process is well suited for solvent extractions depending upon differences in molecular weight or polarity, as well as crystallizations based on degree of saturation.

Considering the use of propane in solvent extraction, the solubility of the fat and oil components depends on the temperature of the liquid propane contacting medium. For example, as the temperature of the propane solution is raised, high molecular weight components of the oil are thrown out of solution until at temperatures near the propane critical temperature (260 deg. F.) only the very high molecular weight materials—such as oxygenated bodies, unsaponifiables, phosphatides, polymerized materials and color bodies—would not be in solution. Thus the amount of separation depends on the temperature of that particular contacting tower. In this way, fatty acids, lecithin, color and odor bodies, and vitamins may be removed from the oil, to mention several industrial applications.[5]

The system may be used for solvent decrystallization in much the same way as propane is used for solvent dewaxing of petroleum stocks. A certain amount of propane is allowed to vaporize, thus furnishing its own refrigeration and crystallizing out the saturated oil or fat from the unsaturated. This would be useful in the production of highly effective drying oils.

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Salaries for Young Chemical Engineers

E. C. FETTER

Secy.-Treas., Junior Chemical Engineers of New York

What is your present salary? How many years industrial experience have you had? What degrees—bachelor, master, doctor—do you hold?

In March of this year these three questions were put to 810 young chemical engineers employed in the vicinity of New York City. The responses, 511 in number, are summarized in Figs. 1 and 2 below.

Fig. 1 was obtained by sorting the responses into 12 groups according to experience, then arranging each experience group in the order of ascending salary, and finally, by simple counting, finding and plotting the salaries that would divide the group into top and bottom tenths, quarters, and halves. Thus, for example, a man with six years experience and earning $450 per month can compare his salary with 90 of his contemporaries and see that he is earning more than 75 percent of them but not as much as the remaining 25 percent. He can tell not only how many salaries are above and below his own but, by observing the vertical spread between curves, he can tell something of how much more and how much less the rest of his group is earning.

No distinction is made in Fig. 1 between bachelors, masters and doctors. To contrast the earning power of these different degrees, each experience-group was subdivided degree-wise. The table in Fig. 2 shows the number of men in each subdivision. The curves of Fig. 2 show the average salary for each of the subdivisions and for the combined group.

A striking feature of the curves is the dip in salary for the group with nine years experience. Presumably these men started to work in 1938, which, it will be remembered, was a year of general economic recession. It appears that the group so unfortunate as to enter industry in that year got off to a bad start and never made it up.

But notice in Fig. 2 that it was the doctors and masters considerably the bachelors are about on schedule. Further, the table shows only 29 returns for the 9-year group, compared to 43 and 48 returns for the years before and after. Also, in this group the doctors and masters considerably outnumber the bachelors, which is quite the reverse of the proportions in other years. Perhaps then, we may put these several facts together and deduce that 1938 was a hard year to get jobs; that the masters and doctors got more than their normal share of them; but that they had to accept bachelors salaries to do it.

The data presented here were obtained by sending questionnaires to two groups of young chemical engineers—195 to the mailing list of the Junior Chemical Engineers of New York and 615 to those on the mailing list of the American Institute of Chemical Engineers who are classified by the Institute as Juniors within the Metropolitan District. Although the survey was initiated and conducted by the Junior Chemical Engineers as a regular annual activity, the cooperation of the New York Section of the Institute was invaluable in that its larger membership multiplied the number of returns several times over.

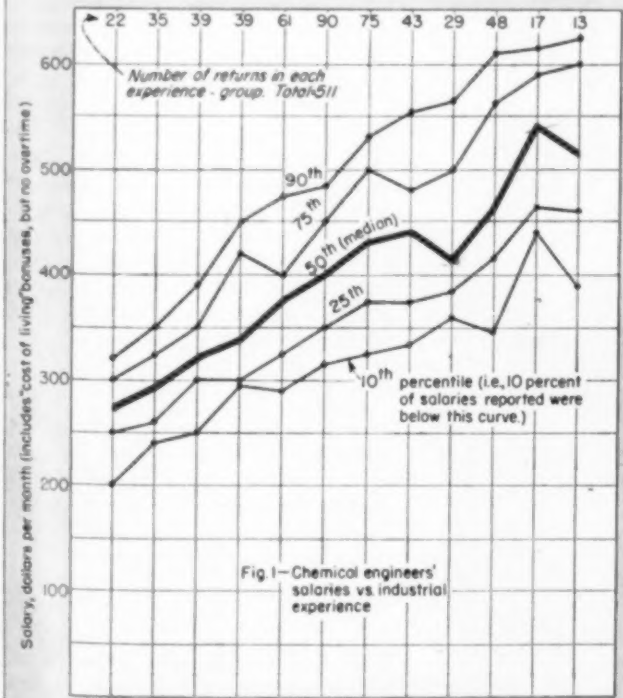


Fig. 1—Chemical engineers' salaries vs. industrial experience

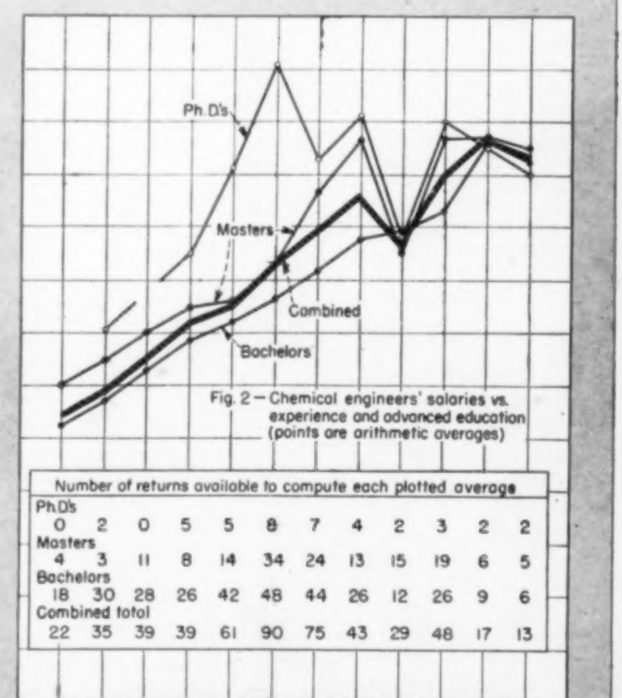


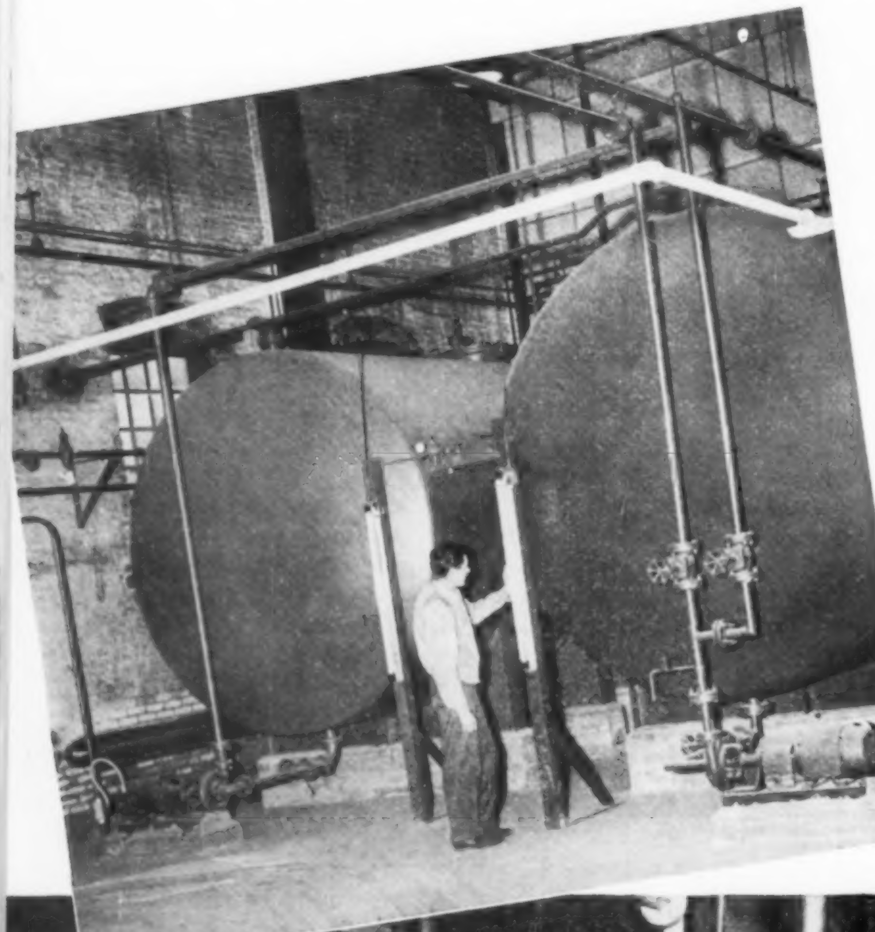
Fig. 2—Chemical engineers' salaries vs. experience and advanced education (points are arithmetic averages)

Number of returns available to compute each plotted average

	1	2	3	4	5	6	7	8	9	10	11	12
Ph.D's	0	2	0	5	5	8	7	4	2	3	2	2
Masters	4	3	11	8	14	34	24	13	15	19	6	5
Bachelors	18	30	28	26	42	48	44	26	12	26	9	6
Combined total	22	35	39	39	61	90	75	43	29	48	17	13

CORROSION RESISTANT CEMENT PRODUCTION

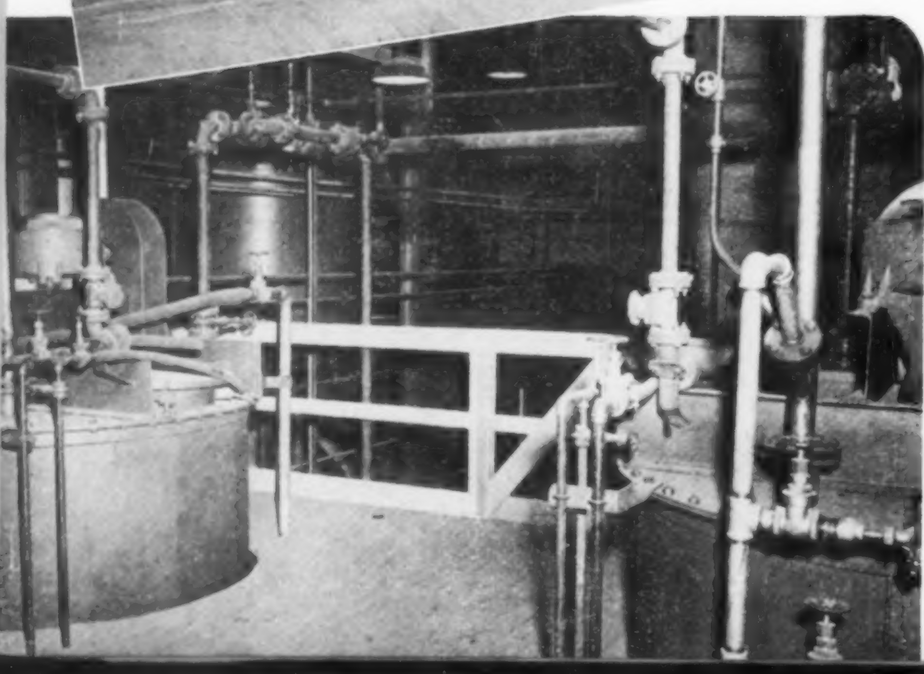
A NEW PLANT USES AUTOMATIC CONTROLS TO PRODUCE FORMALDEHYDE RESINS FOR ANTI-CORROSION CEMENTS



CONSTRUCTION of a new plant for the manufacture of corrosion resistant cements at Natrona, Pa., has been completed by the Pennsylvania Salt Mfg. Co. This plant embodies special improvements for the manufacture of such new resin cements as an acid, alkali and solvent resistant cement for floor construction; a quick setting cement, and a cement designed particularly for construction where hydrofluoric acid is used.

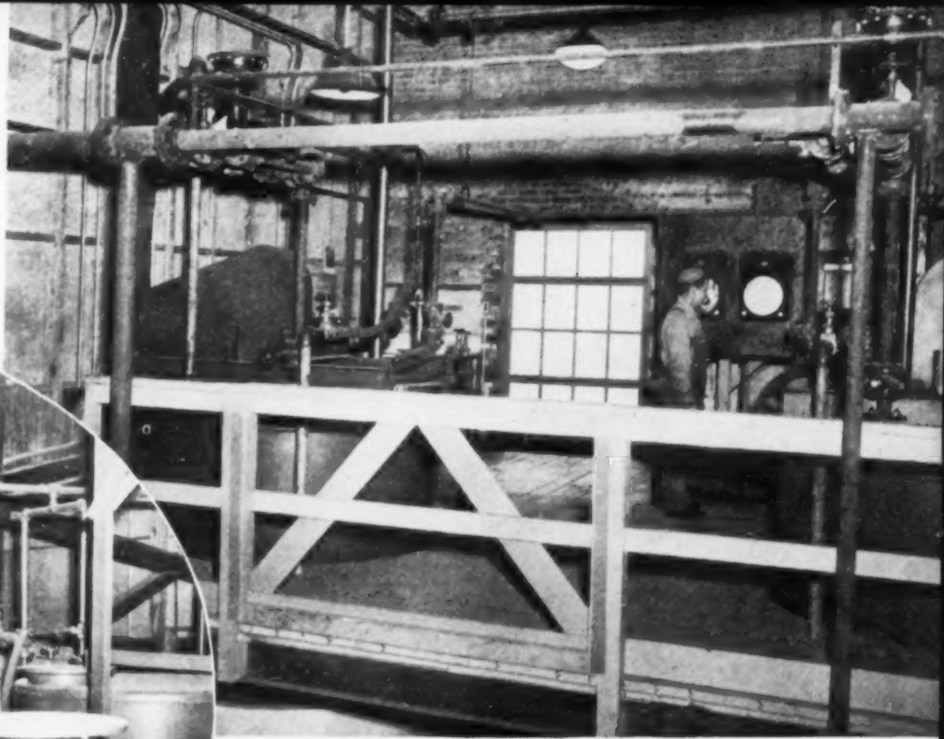
The new cement unit doubles Pennsalt's production capacity for these products and provides for expansion into other products new in the development stage. Uniform high quality is insured by use of automatic control equipment and in no instance does quality depend on the judgment of operators. All material is conveyed mechanically at all steps and is not subject to any contamination. The entire process is well ventilated. New packaging equipment has been installed and ample storage space for raw materials and warehousing for finished products, thus assuring good inventory position and faster customer service. The series of pictures illustrates the plant's operations.

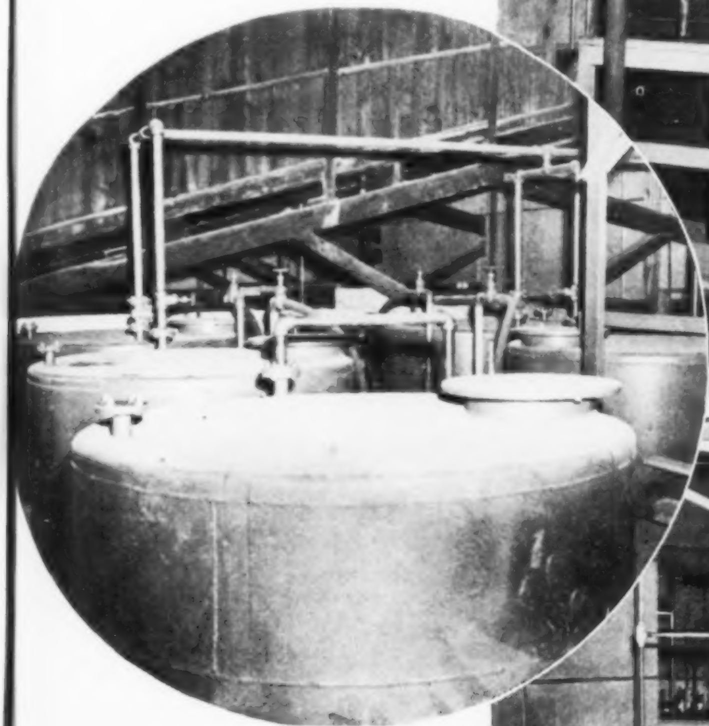
Above—Here an operator measures raw material stock of phenol and formaldehyde in storage tanks by reading the Tank-O-Meter gage. By these measurements the operator is aware at all times of his exact raw material stock



Left—In these reactors the phenol is condensed with the formaldehyde to form resin. Catalysts and plasticizers are added in the reaction tanks

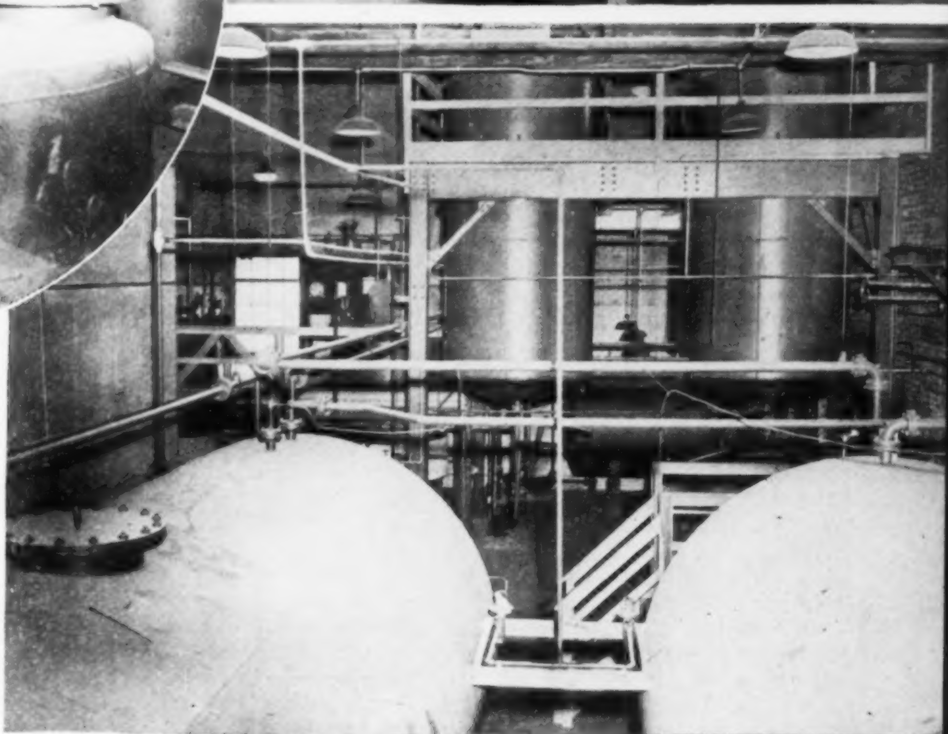
Rigid temperature controls must be maintained in the exothermic reaction. The Bristol recorder shown indicates and records temperatures and controls the heating and cooling of batches automatically. Valves activated by it are in the upper right and left



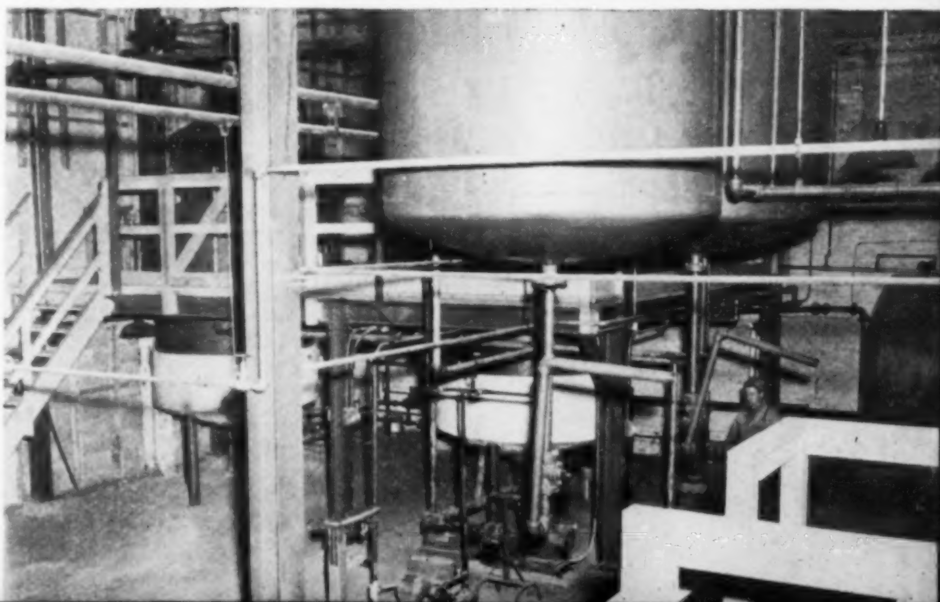


Above—After treating in the reactors, the material is transferred automatically to these product settling tanks. In this battery of tanks the material is aged before final adjustment

Right—Following aging and final adjustment, the material is stored in the two vertical storage tanks shown at the rear in this picture. The reactors can be seen to the left rear of the finished product storage tanks



This picture shows an operator at the loading spouts, ready to fill drums with finished resin solution from the vertical storage tanks. It is ready to be mixed with suitable powder to make the desired corrosion resistant cement. The powder is made in another new unit of the plant not shown here



STANDARD SYMBOLS
For Chemical Engineers

*J. H. PERRY**

Chairman, the 1946 ASA Subcommittee No. 12 on Letter Symbols for Chemical Engineering
Chairman, AIChE Committee on Standard System of Symbols and Nomenclature Covering Unit Operations

FOR THE SAKE OF CONSISTENCY CHEMICAL ENGINEERS ARE URGED TO ADOPT THIS STANDARD SYSTEM OF NOTATION

Resulting from work started before the war, an American Standard of letter symbols for chemical engineering has been developed and approved by the American Institute of Chemical Engineers and the American Standards Association. Chemical Engineering *presents this article to bring the Standard to the attention of all chemical engineers.*

On the opposite page is presented a tabulation, "Chemical Engineering Notation," which includes the letter symbols of the concepts most used in the unit operations of chemical engineering. This list of letter symbols has been approved by the American Standards Association and designated an American Standard, having previously been adopted by the American Institute of Chemical Engineers.

In the development of any standard it is necessary to choose certain symbols and abbreviations from two or more that are in current usage by many people. Usage of a specific symbol or abbreviation has been taken into account but logic and consistency are the bases on which the final selections are made. The selection of a specific symbol for a specific concept necessitates the abandonment of many symbols and abbreviations that are ingrained in the habits of many individuals through their previous education, training, and experience. The motto of our country, *E Pluribus Unum*, is not more true of our country's history than it is of the development of a standard symbol or abbreviation. In the preparation of the present American Standard, the committee members have had to yield in their preferences for many symbols.

Abbreviations

While not an official part of ASA Z10.12—1946, the practice adopted by the AIChE with respect to names of units for a self-consistent set and the abbreviations for these units appear in the printed list. The basic set of these units is as given on the page opposite, following the list of symbols. In this respect, the recommendations of the AIChE do not conform with the ASA Standards on Abbreviations for Scientific and Engineering Terms, ASA Z10.1—1941, which recommends the omission of periods after abbreviations. The subcommittee has insisted that periods be used after abbreviations (employing lower-case characters) because it is believed that they contribute materially to clear understanding as much as other marks of punctuation and therefore obviate any hesitation in defining an abbreviation.

In addition, the AIChE Committee has retained, in giving its recommendations for names of units, the use of the slant bar instead of the word "per," as this subcommittee believes that the slant bar is commonly recognized as the shorthand symbol of "per." Parentheses, likewise, are required for clarity and accuracy in many of the more complex dimension statements, in their opinion. However, the present American Standard contains several instances where the subcommittee has yielded to other groups in the American Standards Association in the adjustment to, and inclusions of, letter symbols that are items of previously-established American Standards. Some of the more important of these adjustments are taken care of by the inclusion in the present Standards of alternate symbols.

All progress is evolutionary and optimum progress is best obtained by frequent small changes rather than by sudden revolutionary changes. The present subcommittee believes that the present American Standard is a real and valuable milestone in the progress of standardization of the letter symbols of the chemical engineering unit operations. Complete agreement and complete acceptance should and will be the result of further work of all committees and by the whole-hearted cooperation of all who use these symbols.

An appeal is made to all chemical engineers to adopt and use this Standard in all of their professional work, whether such work is teaching with its lectures and examinations, business correspondence, including intra-company office memorandums, the writing of magazine articles and books, and all other professional or other work that utilizes chemical engineering letter symbols and abbreviations. It should be emphasized that each chemical engineer is and will be an important, if unofficial, member of the AIChE and ASA committees to revise and improve the present Standard. All constructive criticisms are welcomed by the committee.

* With J. R. Callaham, *"Chemical Engineering,* McGraw-Hill Publishing Co.; T. H. Chilton, E. I. du Pont de Nemours & Co.; O. A. Hougen, University of Wisconsin; W. H. McAdams, Massachusetts Institute of Technology; W. L. McCabe, Carnegie Institute of Technology (now of Flintkote Co.); F. J. Van Antwerpen, *Chemical Engineering Progress,* AIChE.

CHEMICAL ENGINEERING NOTATION

Adopted by American Institute of Chemical Engineers and American Standards Association, ASA Z10.12—1946

These symbols are presented to encourage general use. Parentheses indicate occasional alternates.

Absorptivity (for radiation)—α (alpha)
Acceleration—a
Acceleration of gravity—g
  standard value—g_0
Activity—a
Activity coefficient, molal basis—γ (gamma), (f)
Angle—α (alpha), (θ (theta), ϕ (phi))
  solid—ω (omega)
Angular velocity—ω (omega)
Aperture—A, a
Area—A, S
Base of natural logarithms—e
Bottoms, residue, waste—W, B
Breadth, width—b
Coefficient
  activity, molal basis—(f), γ (gamma)
  discharge, etc.—C
  expansion, linear—α (alpha)
  expansion, volumetric—β (beta)
  friction—f
  gas film, mass transfer—k_G
  heat transfer, individual—h
  heat transfer, over-all—U
  individual, mass transfer—k
  liquid film, mass transfer—k_L
  overall, mass transfer—K
    gas film basis—K_G
    liquid film basis—K_L
  resistance—C
Compressibility
  cake, exponent of—s
  factor—z
Concentration, volumetric—c
Conductance, thermal—C
Conductivity, thermal—k
Constant
  equilibrium, $y=Kx$, K, or (K^*)
  gas, universal—R
  Stefan-Boltzman—σ (sigma)
Cross section—A, S
Density—ρ (rho)
Depth—y
Diameter—D
Difference, finite—Δ (capital delta)
Differential operator—d
Diffusivity, thermal—α (alpha)
Diffusivity of vapor—D_v
Distance above datum plane—Z
  in direction of flow—x
Distillate rate—D
Efficiency—η (eta)
Emissivity (for radiation)—ϵ (epsilon)
Energy
  free, Gibbs, $(H-TS)$, G, or (F)
  general—E
  internal—U
  internal, per unit weight—u
Enthalpy—H
  per unit weight—h, (i)
Entrainment ratio—E
Entropy—S
  per unit weight—s
Equilibrium
  curve, slope of—m
  constant, $y=Kx$, K, or (K^*)
  value, mole fraction in vapor—y^*
Equivalent resistance of cloth—r

Evaporation—E
  latent heat of—h_{fg}, λ (lambda)
Expansion:
  linear, cofficient of—α (alpha)
  volumetric, coefficient of—β (beta)
Exponent of compressibility of cake—s
External work—W_e
Fanning friction factor—f
Feed, thermal condition of, $(L_m-L_n)/F$, q
  rate—F
Film
  mass transfer coefficient
    liquid—k_L
    gas—k_G
  thickness, effective—B
Flow
  rate, mass—w
  volumetric, rate of—q
  weight rate per unit of breadth—Γ (capital gamma)
Force, total load—F
Free energy
  Gibbs, $(H-TS)$, G, or (F)
  Helmholtz, $(U-TS)$, A
Free moisture content—W
Fraction
  volume—x_v
  weight—x_w
Friction
  coefficient of—f
  energy balance—F
  factor, Fanning—f
Fugacity—f
Function—ϕ (phi), ψ (psi), χ (chi)
Gas
  constant, universal—R
Gravity
  acceleration of—g
  standard value, acceleration of—g_0
Heat
  humid—c_s
  latent, of evaporation—λ (lambda), h_{fg}
  mechanical equivalent of—J
  quantity of—Q
  specific—c
  specific, constant pressure—c_p
  specific, constant volume—c_v
  specific, ratio of, c_p/c_v—k, κ (kappa), γ (gamma)
  transfer
    coefficient, over-all—U
    factor—j
    individual, coefficient of—h
    rate of—q
Height—Z
  equivalent to a theoretical plate, "H.E.T.P."—H_p
  of transfer unit, "H.T.U."—H_t
Henry's law constant, c/p, H
Humid
  heat—c_s
  volume—v_H
Humidity—H
  relative—H_R
Hydraulic radius—R_H
Inertia, moment of—I
Length—L
Liquid
  rate—L
  above feed—L_n
    below feed—L_m
Logarithms, base of natural—e

Mass—m
  flow rate—w
  transfer coefficient
    gas film—k_G
    individual—k
    liquid film—k_L
    over-all—K
      gas film basis—K_G
      liquid film basis—K_L
  velocity—G
    of liquid—L
Matter, quantity of, weight—W
Mesh—M, m
Moisture content, free—W
Mole
  fraction
    in liquid—x
    in vapor—y
    in vapor, equilibrium value—y^*
  ratio, in liquid—X
  ratio, in vapor—Y
Molecular weight—M
Moment of inertia—I
Newton law of motion, conversion factor—g_c
Number in general—N
Plates, number of—N_p
Power—P
Pressure—p
Production rate—R
Radiation, intensity of—N
Radius—r
  hydraulic—R_H
Ratio
  mole in liquid—X
  mole in vapor—Y
  reduction—R_R
  reflux—R
Rate
  flow, volumetric—q
  heat transfer—q
  liquid, above feed—L_n
  liquid, below feed—L_m
  rotation—n
  transfer—N
  vapor—V
Reduction ratio—R_R
Reflux ratio—R
Relative
  humidity—H_R
  volatility—α (alpha)
Residue, waste, bottoms—W, B
Resistance
  cake, specific—α (alpha)
  cloth, equivalent—r
  coefficient—C
  thermal—R
Rotation, rate of—n
Slope of equilibrium curve—m
Solid angle—ω (omega)
Solubility—S
Solvent present—H_s
Specific
  heat—c
    at constant volume—c_v
    at constant pressure—c_p
  heats, ratio of, c_p/c_v, k, κ (kappa), γ (gamma)
  surface—s
  volume—v
Stefan-Boltzmann constant—σ (sigma)
Surface
  per unit volume—a
  specific—s
  tension—σ (sigma)

Temperature—t
  absolute—T
Theoretical plate, equivalent, height of, "H.E.T.P."—H_p
Thermal
  condition of feed, $(L_m-L_n)/F$, q
  conductance—C
  conductivity—k
  diffusivity—α (alpha)
  resistance—R
Thickness, film, effective—B
Time—t, τ (tau), (θ (theta))
Tractive force per unit area—τ (tau)
Transfer
  rate of—N
  unit, "H.T.U.," height of—H_t
  units, number of—N_t
Vapor
  mole ratio—Y
  rate—V
Velocity
  acoustic—V_s, c
  angular—ω (omega)
  average—V
  local—u
  mass—G
  mass, of liquid—L
Viscosity
  absolute—μ (mu), (η (eta))
  kinematic—ν (nu)
Volatility, relative—α (alpha)
Volume
  fraction—x_v
  humid—v_H
  specific—v
  total or per mole—V
Waste
  bottoms, residue—B, W
Weight
  fraction—x_w
  quantity of matter—W
  rate of flow per unit of breadth—Γ (capital gamma)
Width, breadth—b
Work—W, W_k
  external—W_e

Abbreviations for names of units to be used with numerical values are based upon the following. Abbreviations are the same for plural as for singular form.

Energy
  British Thermal Unit—B.t.u.
  Pound Centigrade Unit—P.c.u.
  Kilowatt—kw.
Length
  foot—ft.
  centimeter—cm.
Mass
  pound—lb.
  gram—g.
Temperature
  degree
    Centigrade—°C.
    Fahrenheit—°F.
    Kelvin—°K.
    Rankine—°R.
Time
  second—sec.
  minute—min.
  hour—hr.
Volume
  gallon—gal.
  cubic centimeter—cc.
  liter—l.

Oxygen Gasification of Anthracite

C. C. WRIGHT and L. L. NEWMAN

Respectively, Div. of Fuel Technology, Penna. State College, and Synthetic Liquid Fuels Div., U. S. Bureau of Mines

RECENT INVESTIGATION ADDS ANTHRACITE TO THE LIST OF SOLID FUELS SUITABLE FOR GASIFICATION WITH PURE OXYGEN AND STEAM

To obtain information regarding the quality of gas that can be produced and the techniques for anthracite-oxygen operations, the Anthracite Institute appropriated funds and authorized the research staff of the Division of Fuel Technology of the Pennsylvania State College to conduct test work on the oxygen gasification of two sizes of anthracite coal, namely, rice and barley.

Through the courtesy of the management of the Consolidated Mining and Smelting Co. of Canada, Ltd., arrangements were made to perform the tests in the Wellman-Galusha producers currently in use for the manufacture of synthesis gas from coke by oxygen gasification at Trail, British Columbia.

Six cars of Pennsylvania anthracite of rice and barley sizes were shipped to Trail for the test work and various organizations interested in the study were invited to cooperate. The test procedure followed was substantially that recommended in the ASME Test Code for Gas Producers.

This is a condensation of a report presented before the American Gas Association, Joint Production and Chemical Conference, New York City, June 4, 1947.

The character of the ashes produced from the rice and barley sizes of anthracite when oxygen was used was found to differ markedly from these for air-blown operations; fuel bed conditions tended to change much faster owing to the use of oxygen; it was absolutely essential that a good layer of protective ash be maintained on the grates to prevent burning of the metal; and a major portion of the steam requirements had to be supplied from an external source.

Conclusions

Contrary to general practice with air-blown producers, extensive poking and barring of the bed are not generally practiced with the oxygen-blown coke operations unless clinker or ash crust is especially serious. Compared with air-blown operations, most of the fires both with anthracite and coke would have been classed as being in very poor condition, frequently exhibiting double zones and long hot zones on poke-bar tests, yet the fires generally righted themselves with a minimum of hand working, and the quality of the gas appeared to be unimpaired by the lack of uniform bed conditions.

The following conclusions may be drawn:

1. Rice-size anthracite can be satisfactorily gasified in stationary fuel beds using oxygen and steam to yield high-quality gas suitable for use in ammonia, methanol or gasoline synthesis at gasification rates at least 100 percent higher than gasification rates for the same size fuel in the same producer when air and steam are used.

2. Barley-size anthracite can be satisfactorily gasified in stationary fuel beds using oxygen and steam to yield satisfactory synthesis gas at gasification rates at least as high as those normally attained in the same machine when rice size fuel is used with air and steam. This represents considerably more than a 100 percent increase in capacity.

3. The behavior of the ash from rice and barley anthracite in the oxygen-blown producer differs from the behavior of the ash from air-blown operations or from the ash produced in oxygen-blown operations using large-size coke in that it appears to be surface-sintered, is more compact, and discharges with less motion of the

Operating Results Using Rice and Barley Sizes of Anthracite and Two-Inch Coke

	Rice	Barley	Coke
Duration of test, hr	25	12	29
Fuel consumed, [1]lb	69,280	15,919	72,100
Total gas, [2]M cu. ft	2,987	614	2,970
Fuel gasified, lb./hr./sq. ft	33	17	31.7
Fuel gasified, lb./hr	2,771	1,335	2,490
Cu. ft. gas per lb. fuel	43.1	38.6	41.2
Lb. fuel per M cu. ft gas	23.2	25.8	24.4
Cu. ft. O_2 per M cu. ft. gas	201	220	233
Cu. ft. O_2 per lb. fuel	8.66	8.73	9.6
Lb. steam used per lb. fuel	1.40	1.38	1.01
Lb. steam used per M cu. ft. gas	32.5	35.6	24.6

	Rice	Barley	Coke
Lb. steam decomposed per lb. fuel	0.73	0.58	0.62
Carbon in dry refuse, percent	2.6	3.0	2.0
Gasification efficiency,[3] percent	82.8	76.8	79.8
Gross heating value, B.t.u./cu. ft	271	266	258
Gas composition, percent			
CO_2	16.50	17.20	11.3
O_2	0.15	0.20	0.6
H_2	41.00	37.65	31.0
CO	40.00	42.40	54.1
CH_4	0.85	0.75	0.4
N_2	1.50	1.80	2.6

[1]All fuel data are on as-fired basis. [2]All volumes are at 60 deg. F. and 30 in.Hg. dry. [3]Gasification efficiency = Calorific value of gas from 1 lb of fuel/ (calorfic value of 1 lb. of fuel + heat content above 60 deg. F. of aux. steam/0.75)

grates. The grate spacing and eccentricity setting tested during studies on the oxygen gasification of rice-size coal did not cover a wide enough range to permit continuous motion of the grates with this size of fuel. As a result, the grate failed to maintain the lower part of the fuel bed in slow, steady, but continuous movement—an essential requirement for good performance by a mechanical grate. Further experimental work is required to adapt the Galusha grate to oxygen-blown operations with rice coal.

4. For operation with barley coal the grate spacing and eccentricity established during preliminary tests on oxygen-blown rice-coal operations resulted in better ash removal and fuel bed conditions. The results are not fully conclusive, however, as gasification ratings were not carried to the maximum believed possible with this size of fuel.

5. In all the oxygen gasification tests on anthracite, a considerable amount of manual work was required to break up ash-crust formations with bars driven through the poke holes. Satisfactory operation of the mechanical grate probably would eliminate a substantial part of this labor.

6. The composition of the raw gas produced by the oxygen gasification of rice anthracite approached more closely the composition desired in purified synthesis gas than that reported for operation with large coke. Inert content was about the same while tars and condensable residues were not present in detectable amounts.

7. The composition of the raw gas produced by the oxygen gasification of barley anthracite was not quite so satisfactory as that from rice coal, which may be due to inability to establish optimum operating conditions with the limited quantity of barley coal.

8. Fuel gas with an average gross heating value of 305 B.t.u. per cu.ft. was produced for one 7-hr. test, using rice anthracite at a gasification rate of about 2,750 lb. of fuel per hour.

9. The coal consumption per M cu.ft. of raw gas was, respectively, 23.2 and 25.9 lb. as fired for the oxygen gasification of rice and barley anthracite. The coal consumption per therm was, respectively, 8.55 and 9.73 lb. as-fired for the rice and barley anthracite.

10. Oxygen consumption per M cu.ft. of raw gas per lb. of fuel gasified was appreciably lower for rice coal and slightly lower for barley coal than for large coke at comparable ratings.

11. Steam consumption per M cu.ft. of raw gas and per lb. of fuel gasified was appreciably higher for both rice and barley coal than for large coke. The pounds of steam decomposed per pound of rice coal was, however, appreciably higher than for either barley coal or large coke at comparable ratings.

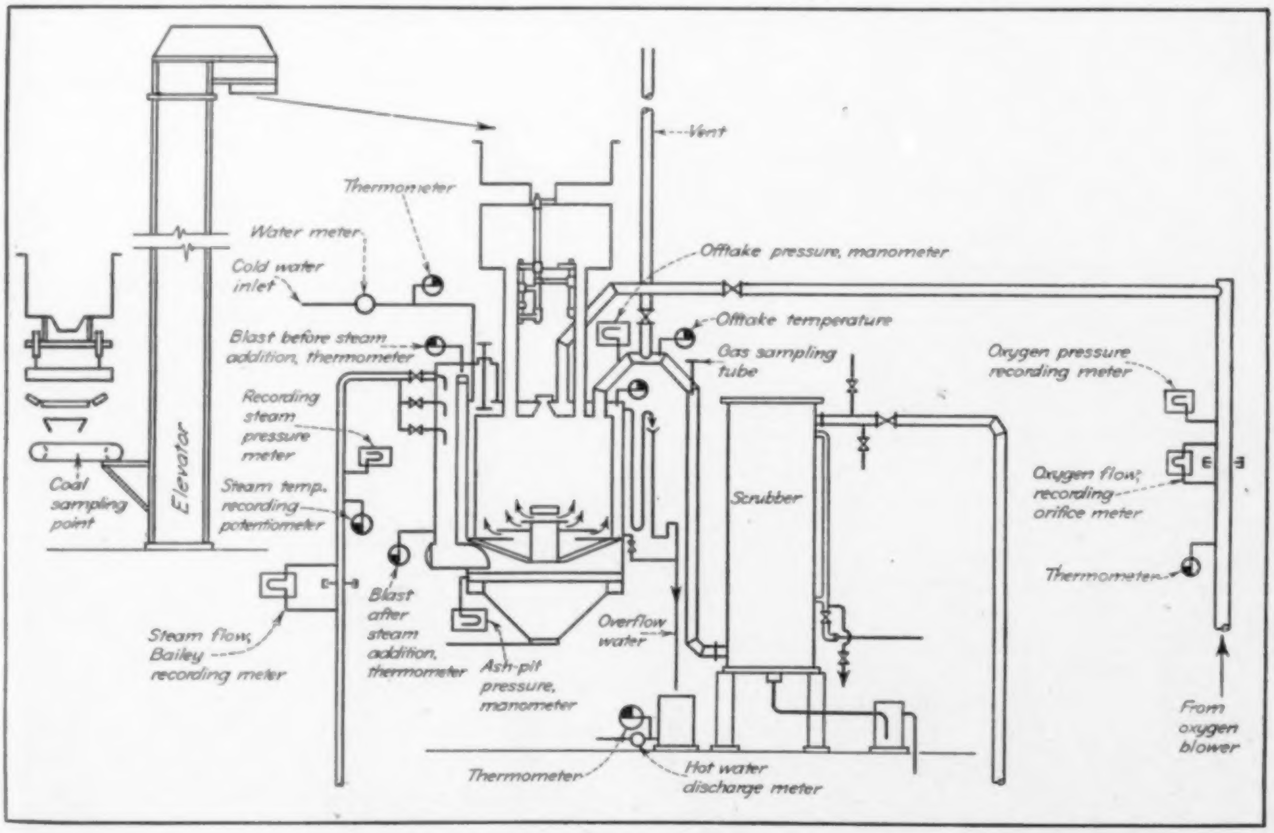
12. From all the tests with anthracite, the refuse showed remarkably low loss of carbon, the percentage of carbon in the refuse in no case exceeding 3 percent. The results compare favorably with similar data for loss of carbon in the refuse from the oxygen gasification of large coke.

Heat Balance for Code Test with Rice Anthracite

Input	B.t.u.	Percent
Calorific value of fuel	12,250	90.0
Sensible heat of fuel	0	0.0
Total heat in water supplied	−31	−0.2
Total heat of steam entering	1,375	10.1
Sensible heat of oxygen entering	3	0.0
Total heat of water in oxygen entering	18	0.1
	13,615	100.0
Output		
Calorific value of gas	11,664	85.7
Sensible heat of dry gas	717	5.3
Total heat of water vapor in gas	1,022	7.5
Sensible heat of ashes	3	0.0
Heat lost in jacket overflow water	436	3.2
Calorific value of ashes	40	0.3
Radiation and convection loss	31	0.2
Errors and unaccounted for	−298	−2.2
	13,615	100.0

Basis: 1 lb. of fuel as fired. Reference temp. 68 deg. F.

Diagrammatic sketch of gas producer and auxiliaries showing location of test equipment



EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

TOO LITTLE WATER?

PROCESS industries are among the largest users of water. It is a matter of great importance, therefore, when it becomes evident that the groundwater supply in many areas is being depleted, or the surface water supply is reduced either in volume or purity. Industry can not hope to be given priority over city supply or sanitary-water supply. But it can well ask that it be given precedence over navigation, irrigation, and other secondary uses less vital to continued American enterprise.

It is necessary right now that process engineers in many areas survey their water supply more critically than they have ever done before. If the water table in an area is slowly falling, it is necessary to determine how adequate water will be had when the groundwater falls below the level from which it is economic to pump it. Equally pertinent are surveys of nearby streams to determine stability of flow, sources of contamination, potential diversion for off-river purposes, and prospective rise in temperature due to cooling uses upstream.

Uncle Sam is beginning to concern himself about these matters on a national scale. It is even more important that each individual enterprise concern itself with its own local and specific problems.

DRYING UP THE SOURCES

RIGHT now more millions are going into plant expansions and betterments than ever before in our peacetime history. As the national economy is gradually shifting from consumer to durable goods, capital investment in machinery and equipment is assuming boom-like proportions. This money normally comes solely from the savings of corporations and individuals. Today, the great bulk of the financing is being done through the use of the accumulated liquid assets of industry rather than through new stock issues or the so-called "risk capital" of individuals. One of the reasons for this change in source, which some economists regard as a dangerous threat to the future of the individual enterprise system, is found in our present tax structure—particularly in connection with income taxes on salaries upwards of $5,000 per year.

Studies by Drs. Carl Snyder and Willford I. King of New York University show that the relatively small proportion of our citizens who receive such incomes account for 74 percent of the investments made in new security issues. During the thirties this group saw its savings seriously reduced by heavy taxes on depressed earnings. Less money was available for investment and industry suffered accordingly. During the war industrial profits have mounted and in spite of taxes most of the larger companies have been able to set aside reserves for their postwar construction programs. When these are exhausted and when smaller new enterprises want to enter the field, industry must again turn to the investor. It is appropriate, therefore, to see what incentives there are for such investments by individuals.

Present surtax rates now reach 50 percent at $18,000, 68 percent at $44,000, 77 percent at $70,000. It may be argued that any tax system which takes more than half of a man's earnings in peacetime robs him of much of his incentive for taking on additional responsibilities. When the proportion reaches two-thirds or three-fourths, the citizen may well wonder whether the game is worth the playing. And when this happens, we dry up the wellsprings of risk capital that have put American industry so far ahead of that of the rest of the world.

These are some of the facts that must be considered in connection with the urgent necessity for tax reduction. It is far more than a fiscal issue. We need but look to Britain to see what can be the long-time effects of a heavily graduated income tax on individuals. Confiscatory taxation, by drying up the sources of capital, can lead to socialism and the nationalization of industries.

MISGUIDED ZEAL

COMMENDABLE zeal in preventing fires of disaster proportions apparently carried the President's National Fire Prevention Conference in Washington a bit too far in one case. The impression was given that painted surfaces represented a fire hazard if the paint was on an oil base rather than water base. Fortunately, this error was rejected by the Conference.

When highly combustible material such as paint-soaked burlap is used for false ceiling and decorative purposes, such construction may become very dangerous. Apparently this general kind of thing contributed both to the LaSalle Hotel fire in Chicago and the later Winecoff Hotel disaster at Atlanta. But the paint was only an incident. The "false front" was most at fault.

The paint industry is rightly disturbed that its contribution to good construction should be so criticized by thoughtless zeal. Engineers well know that painted surfaces often fire less readily than unpainted surfaces. And certainly dried-out wood is more of a hazard than properly maintained wooden and plaster surfaces finished with oil-base paints.

Chemical engineers commend the zeal, but rightly ask for a bit more discriminating application.

NEW FLUORINE SOURCE?

DEMANDS for liquid fluorine, hydrofluoric acid, and other fluorine compounds are growing at an amazing rate. So is the hunt for fluorine raw materials. Chemical-grade fluorspar is in demand on a scale hitherto unequalled.

There is one untapped and neglected source of fluorine that seems to deserve intensive study. We refer to phosphate rock from which fluorine must be eliminated as a part of the job for making "available" phosphate for fertilizer. One wonders why there has not yet been a successful development of means for recovery of elemental fluorine, which at present is essentially a nuisance factor in superphosphate plants.

American enterprise mines more than four million tons a year of phosphate rock, which contains from 1½ to 2 percent of elemental fluorine. Most of this is eliminated during processing; but the quantity which is recovered is very small. It seems as though good chemical engineering development might well make available this material which certainly amounts to between 100 and 300 millions of pounds of fluorine per day. A lot of fluorine chemicals could be made from this raw material if we found a sound economic procedure for its recovery.

SAFETY ALL WAYS ALWAYS

When we began to study chemical engineering in school, most of us were taught the ABC's of safety in handling chemicals and apparatus. If we were well taught, those ABC's of safety are now subconsciously guiding our actions around the laboratory and plant. However, it is not inappropriate to review our "alphabet" occasionally, because of new "letters" which are added to it as science and technology progress.

Alpha Chi Sigma, national chemical fraternity, has been active in the field of safety. Recently there came to our attention a very concise presentation of the ABC's that we were mentioning above, when the following four classes of safety problems were outlined in a statement of the George Washington University chapter of Alpha Chi Sigma:

"1. Dangers arising from the frequent use of corrosive liquids such as mineral acids and alkalis.

"2. Fire hazards inherent in the use of flammable volatile solvents such as benzene, ether, etc.

"3. Poisonings from such agents as mercury, lead, cyanides, oxalates, and hydrogen sulphide, as well as volatile organic liquids.

"4. Careless handling of glass apparatus and its operation under pressure and vacuum."

Certainly these basic problems underlie most of the hazards which confront us in our daily engineering work with chemicals. And no truer words were ever spoken than the following conclusion, also quoted from the George Washington University chapter:

"A safety program is no stronger than the importance each individual ascribes to it."

TOO FREQUENT SHIFTS

Again the Navy Department, doubtless for good reason, has named a new commanding officer for one of its largest research agencies, Naval Ordnance Laboratory. The former administrator who has served there barely fifteen months, is being replaced by a distinguished admiral.

Such frequent substitutions of commanding officers is most unfortunate. This comment is not intended to be critical of the Navy's selection of officers. We are not well enough advised to know who is the better for this command. But without any greater knowledge of the situation, we are justifiably convinced that frequent changing of top executives in research is not conducive to getting of best results.

When and if we achieve a National Science Foundation, there should be a sincere effort made to see whether such changing of top personnel in research positions may not be ended by placing final authority in civilian hands. Certainly civilian "command" would have great merit from the standpoint of planning and getting things done. It should be, and could be, also adequately responsive to military need and to Naval tradition.

At a time like this, when effectiveness of research for national security is so important, it is most unfortunate that programs are handicapped by overfrequent changes in top personnel.

LOOKING FOR NEW LEADERS

Seventeen years ago the Institute of Paper Chemistry, Appleton, Wisc., set a new pattern of industry education. It was established to provide training at graduate level for a limited number of promising young scientists and technologists. To date it has granted more than 80 degrees to doctors of philosophy of whom more than 98 percent are now employed in responsible positions within the paper and allied industries. Young men are enrolled on a national basis from among university graduates in chemistry and chemical engineering courses. They are carefully selected following stringent tests for aptitudes in science, mechanics, business acumen, personality and temperament. Their courses are in basic sciences and their industrial applications, with the emphasis on fundamental problems of the paper industry. But there is no narrow trade school specializations, no so-called "practical" courses in operating processes. In short the concentration is on fundamentals to be gained from several years spent in intimate association with outstanding scientists in the pulp and paper industry.

Seven years ago when we attended for the first time one of the Institute's annual Executives Conferences, we were impressed with the serious interest taken by these industrial leaders in this unique educational program. They listened intently to slightly immature papers presented by the new graduates but by the time the meeting was over each of the boys had found a job in the industry.

A few weeks ago we attended another of these annual conferences of the Institute with its industrial sponsors. Again we were impressed with the vision, zeal and resourcefulness of the program. Again we were impressed with the executives' insatiable interest in new manpower. Because the demand was so far in excess of supply the industry decided something must be done about it. Offers came immediately to endow several new scholarships. A committee was appointed to explore other ways and means of broadening the base of the program and building on it a bigger pyramid of educational service to the industry. The need is evident. So is the opportunity for young scientists of high caliber who want to devote an additional three or four years in preparation for an interesting career in the paper and allied industries. Need we add our regret that more industries have not been willing to follow the Institute's educational pattern and program?

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the June winner will be announced in July and his article published in August. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at applicable space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are considered.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

MAY WINNER

A $50 prize will be issued to

KARL E. KUNKEL
Associate Engineer, R. B. MacMullin Associates
Niagara Falls, N. Y.

For an article describing several devices for the control of small flows of acids or other corrosive materials that has been judged the winner of our May contest.

This article will appear in our July issue. Watch for it!

April Contest Prize Winner

PRESSURE COMPENSATING SEAL SOLVES SHAFT PROBLEMS UNDER SEVERE OPERATING CONDITIONS

JOHN W. POSTLER
Chemical Engineer, Cincinnati, Ohio

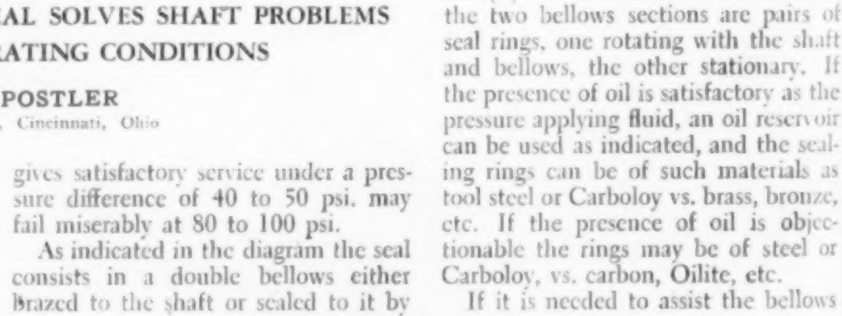
Sealing of pump shafts, agitator drives or other rotating members of chemical equipment has always been a problem to the maintenance man. Especially is this true in operations involving solvents or corrosive liquids at elevated pressures. The use of a simple mechanical seal is satisfactory at low pressures, but at higher pressures leaks develop and attempts to increase the force on the sealing rings cannot help but produce friction, thus leading to heat and eventual break-down.

Using a compound seal might abate the difficulty, but the real answer to the problem lies in the use of a pressure compensating seal, one type of which is shown in the accompanying diagram. Here the compensating pressure $P/2$ is either bled from the system being sealed, or pressure of some suitable fluid such as oxygen, nitrogen, etc., may be introduced from an external source to the space between the two sealing surfaces, so that the differential pressure on each sealing surface need be only about one-half the total value. The success of the device lies in this decrease in differential pressure, which is of great value since a seal that gives satisfactory service under a pressure difference of 40 to 50 psi. may fail miserably at 80 to 100 psi.

As indicated in the diagram the seal consists in a double bellows either brazed to the shaft or sealed to it by means of compression rings, as in Detail (a). At the outer ends of each of the two bellows sections are pairs of seal rings, one rotating with the shaft and bellows, the other stationary. If the presence of oil is satisfactory as the pressure applying fluid, an oil reservoir can be used as indicated, and the sealing rings can be of such materials as tool steel or Carboloy vs. brass, bronze, etc. If the presence of oil is objectionable the rings may be of steel or Carboloy, vs. carbon, Oilite, etc.

If it is needed to assist the bellows

Pressure compensating seal for shafts, showing construction details



in sealing, a spring can be used outside the bellows as shown. In the event that the shaft goes through a plate and there is no stuffing box, it is merely necessary to elongate the outer cup as shown in Detail (*b*).

INDICATING FLOW METER FOR PROCESS LIQUIDS

ARNE BERGHOLM
Bofors, Sweden

In most industrial plants there is an obvious need for liquid flow meters, merely to indicate that the desired rate of flow is fairly well maintained. For such purposes, the type illustrated here has proved to be very useful.

This meter consists of a vertical tube as in Fig. 1, mounted on a round plate and fitted with a deflecting shield on the top of the tube. Near the plate there is hole drilled through the tube wall. The tube is placed in a cylindrical sight glass between two flanges with the plate pressed between the glass and the lower flange.

The flow meter works as follows: The liquid coming from the upper pipe flows over the shield down into the glass. The level rises until the liquid flow through the hole is equal to the flow from the pipe. As the flow through the hole at a given temperature depends only on the height of the liquid column above the hole, the glass can be provided with a scale graduated in flow rate units. This scale is nearly the same for various liquids of low viscosity. Fig. 2 shows the approximate relationship between the height of the column and the flow for different hole diameters. Fig. 3 shows the same relationships when the hole is replaced by a vertical slot. The latter design affords a somewhat lower accuracy but, on the other hand, it can be used for a wider measuring range.

The flow meter can be used in vacuum, as well as under moderate pressure. It is not sensitive to pulsation, and any gas or vapor which might follow the liquid does not affect it.

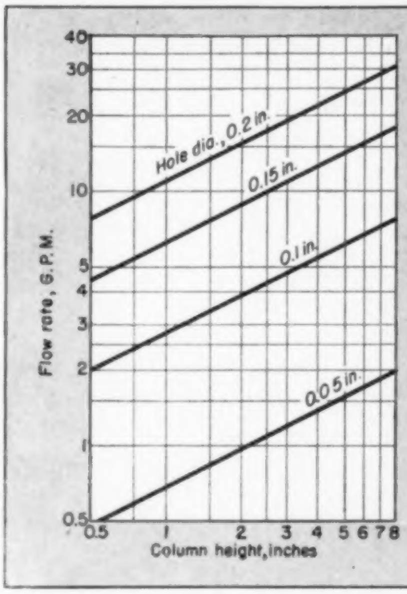


Fig. 2—Calibration of meter for various hole sizes

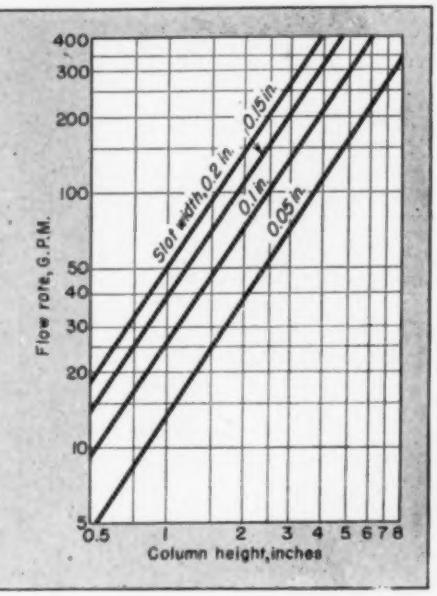


Fig. 3—Calibration of meter for various slot widths

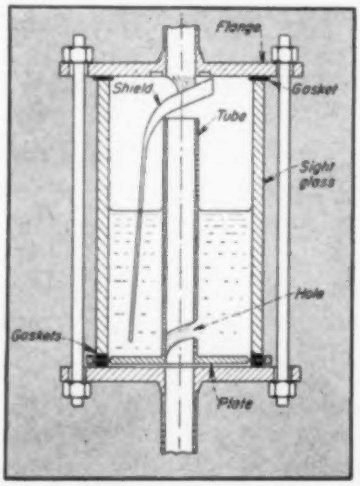


Fig. 1 — Head type indicating flow meter

LEVEL INDICATOR FOR TANK STRUCTURES

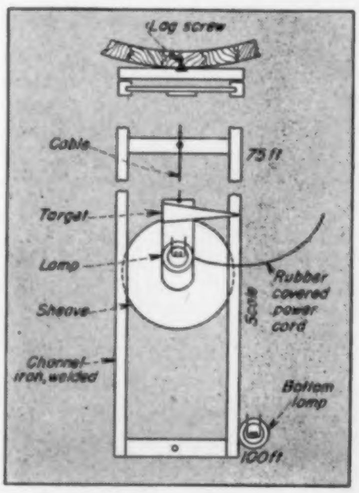
PAUL C. ZIEMKE
Oak Ridge, Tenn.

Given here is a diagram of an improved level indicator for tanks that replaced a device built largely of wood which gave trouble from swelling and freezing in bad weather, almost from the start. The new model is built all of metal and carries an electric light on the target so that the level can readily be judged from a distance both night and day.

The guides and cross members were fabricated from so-called "Uni-Strut" stock, a 1$\frac{5}{8}$x1$\frac{5}{8}$x$\frac{1}{16}$ in. U-channel with a $\frac{7}{8}$ in. wide slot, used largely by electrical firms for mounting electrical equipment on walls and suspending light fixtures from ceilings at abnormal elevations. The indicating weight is a discarded sheave wheel which runs in the "Uni-Strut" grooves. The arrangement assures reliable readings under all weather conditions.

In addition to the 60-watt lamp carried on the indicator, and powered by a rubber covered trailing cable fastened near the center of the tank, two other lights are provided for judging the position of the indicator at night from the power house a block away. These are placed at the upper and lower ends of the scale board. All three are connected into the street lighting circuit and controlled by an astronomical clock to eliminate waste of power and needless lamp renewal.

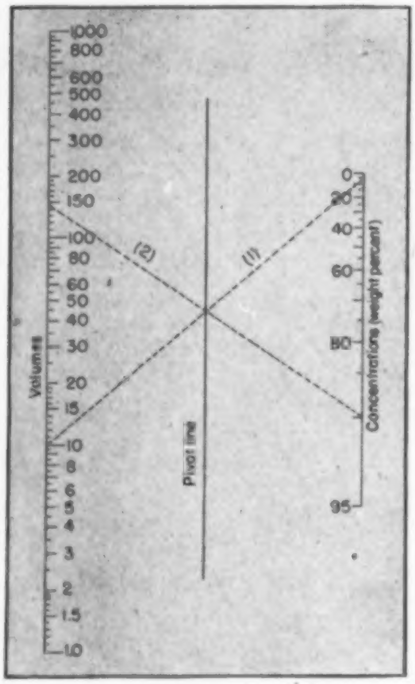
All-metal tank level indicator



ISOPROPYL ALCOHOL SOLUTION MAKE-UP CHART

WILLIAM C. FRISHE
Professor of Chemical Engineering and Metallurgy, Grove City College
Grove City, Pa.

Solutions of isopropyl alcohol and water are ordinarily made up by pumping the commercial alcohol, which is 98 percent alcohol and 2 percent water, into the bottom of a tank containing water or a weak solution of isopropyl alcohol in water. The quantities of initial and final solutions involved are usually measured by volume. In order to calculate the necessary volumes needed to make up a certain concentration one must determine gravities, consult a handbook and then



Nomograph for making up solutions of isopropyl alcohol and water

set up at least one material balance. This process can be greatly shortened by use of the nomograph given here. If one knows (1) the initial volume of weak solution, (2) the concentration of weak solution, and (3) the desired concentration he can readily determine the volume of the final solution without knowing the volume of alcohol pumped in.

In the example shown on the chart: It is desired to make up a solution that is 90 weight percent isopropyl alcohol by pumping the 98 percent alcohol into a tank which contains 10 gal. of an isopropyl alcohol-water solution that is 5 percent isopropyl alcohol by weight. If mixing is thorough, to what volume must the solution rise in the tank?

Solution: On the nomograph connect the volume of weak solution (10) and the concentration of the weak solution (5). This is line No. 1. Connect the final desired concentration (90) with the point of intersection of the pivot line and line No. 1. Continue this straight line (No. 2) to its intersection with the volume axis and read the final volume (145). The calculated result is 144.2 gal.

The equation on which the nomograph is based is derived as follows: Let V, d and C stand for volume (any units), density and weight percent concentration respectively. Let the subscripts 1, 2, and 3 refer to the weak solution, the final solution, and the 98 percent isopropyl alcohol solution respectively. Then by over-all balance:

$$V_1d_1 + V_3d_3 = V_2d_2 \qquad (1)$$

and by an alcohol balance:

$$V_1d_1C_1 + 0.08\ V_3d_3 = V_2d_2C_2 \qquad (2)$$

By combining Equation (1) and (2) so as to eliminate V_3d_3 one gets:

$$\frac{V_2}{V_1} = \frac{d_1(0.98 - C_1)}{d_2(0.98 - C_2)} \qquad (3)$$

The density term can be eliminated by determination of the density-concentration function. Based on data for 20 deg. C. taken from Perry[2] this function is

$$d = 1.015 - 0.23C$$

On substituting this back into Equation (3) one gets:

$$\frac{V_2}{V_1} = \frac{(1.015 - 0.23C_1)(0.98 - C_1)}{(1.015 - 0.23C_2)(0.98 - C_2)} \qquad (4)$$

By use of the methods outlined by Davis[1] the nomograph was constructed from Equation (4).

Although the chart is based on data for 20 deg. C. very small error is involved in ordinary temperature change. The making up of the solution can be done from this chart at any temperature between 10 deg. C. and 30 deg. C. but the initial and final temperatures should be the same.

REFERENCES

1. Davis, "Empirical Equations and Nomography," McGraw-Hill Book Co., Inc., New York, 1943.

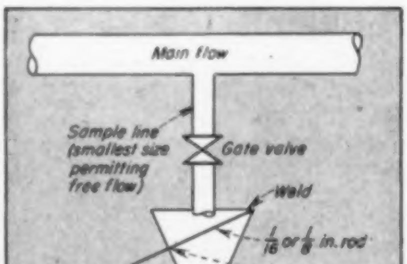
2. Perry, "Chemical Engineers' Handbook," 2nd edition, page 447, McGraw-Hill Book Co., Inc., New York, 1941.

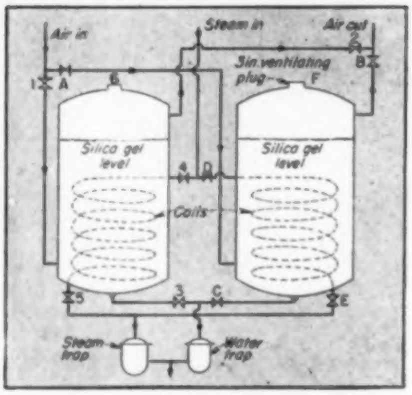
DEVICE FOR OBTAINING AVERAGE SAMPLES

H. P. RILLING
Chemical Engineer
American Enka Corp., Enka, N. C.

A device for taking continuous composite samples of liquids containing suspended solids which would plug a small diversion orifice is shown in the accompanying illustration. The author has used such a sampler successfully, the liquid adhering to and running

Composite sample device for liquids containing solids





Two-tank dryer for instrument air

down the rod being found representative. The rate of take-off can be controlled by either the rod size, or its angle, or both.

DRYING INSTRUMENT AIR WITH SILICA GEL

DONALD RUSHMORE
Chemist, J. & J. Rogers Co.
AuSable Forks, N. Y.

Although the device described here was strictly a wartime expedient, it has worked so satisfactorily that there has been no thought of replacing it. Others with a similar problem may find the details of its construction and operation valuable.

When it was impossible to get new equipment during the war we had considerable trouble with the air operated automatic controls in our boiler house on account of moisture in the compressed air system. The compressor was old, condensation in the pressure tank underground was unavoidable and the air filters on hand were inadequate.

We tried passing the air through a tank of silica gel with excellent results, but the silica gel had to be removed and dried every two or three weeks. The final answer was to build two cylindrical tanks 12x48 in., each with a capacity of about 100 lb. of silica gel. A ½ in.x18 ft. steam coil was placed in the bottom of each tank and the silica gel poured over the coil. One tank was used until the first signs of moisture appeared at the controls, when the second tank was switched on. A 3 in. vent plug was then removed from the top of the first tank and the steam was admitted to the coil at 100 psi. In about a week the silica gel was thoroughly dry and ready to use again. Thus the schedule calls for valves 1, 2 and 3 to be open, with valves 4 and 5 and plug 6 closed, on the vessel currently drying air. Meanwhile, valves A, B and C are closed and valves D and E and Plug F are open on the vessel being regenerated.

"Chem & Met" REPORT ON . . . . .

Achieving PROCESS IMPROVEMENTS

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Process improvements which make possible increased production and improved quality are particularly desirable at this time of raw material shortages. Present high construction costs emphasize the importance of studies directed at the objective of producing more output with present equipment. The achievement of lower costs will be increasingly significant with the return of a more competitive economy. Given the proper opportunity and incentive and a skillful chemical engineer can do much to effect significant process improvements. The author suggests many approaches to the problem and gives examples of results that have been achieved. The avenues of attack which he discusses are not intended to be fully comprehensive but provide a starting point for those chemical engineers not well acquainted with the field.

AFTER a process has been successfully scaled-up from a pilot unit to full-plant size the period of commercial operation that follows provides an opportunity for achieving many refinements by means of research and development investigations. Some of the steps in such a program, originally contemplated as small changes, often contribute major improvements to the industry and results from a profit standpoint are very satisfactory.

One practice frequently followed is to call in outside consultants to take the responsibility for planning and carrying out this class of work. The various specialists available are particularly useful in this connection.

There is much that can be done, however, to effect significant process improvements by the people within an organization if they are given the proper opportunity and incentive. It is the purpose of this article to outline some of the procedures that can be followed in doing this type of process work.

The initial step in such a development program is to make sure by means of organized checking that the process is being properly operated. The correct methods for production should be described in detail in manuals and these made available and in use. This is then followed by utilizing some of the more familiar methods for obtaining increased efficiency. After this first goal of good operation has been reached, minor improvements in the product are sought. Work with a broader viewpoint should then be undertaken which is started with a survey of the process made in order to estimate what can be accomplished along three lines: (1) marked lowering of operating cost, (2) significantly increased output by means of equipment and process changes, and (3) product quality improvements.

A particular group should be assigned the responsibility for making this study which is carried out to provide the groundwork for the investigation. For such a survey to be effective, it must be made by people with experience, resourcefulness, ingenuity and imagination. A comprehensive and thorough study is essential at this point.

Visualizing the possibilities for new developments and then working out unique and useful methods of attack constitute the cornerstone on which to build the program structure. Changes in the speed and type of process will invariably introduce related problems that must be solved before satisfactory plant production can be achieved. Some of these alterations will introduce the need for a very fundamental type of investigation in order to provide the data needed to clarify the issues at hand. There is often

failure to recognize this need and consequently blind plunges are taken at the expense of time and money, which would be avoided if these problems were referred to the laboratory.

One of the most fruitful working premises is that no matter what the capacity of a piece of equipment is considered to be or how much its previous output may have been raised, there is always a possibility for further increases provided the proper skill and experience are brought to bear. Cases where the output of equipment has been increased several fold are common. This is partly due to the fact that designers calculate the capacity on a conservative basis. After this slack in the capacity of a piece of equipment has been taken there is often much remaining that can be done to gain additional output.

Care should be taken to differentiate between trouble-shooting and process development. The former is directed toward maintaining operations and standards at current levels while the latter is directed toward improvements to be added to the present base. Trouble-shooting work often turns up information which is useful in process development. It is therefore important that men working in trouble-shooting should be on the alert to recognize useful findings of the process improvement category. These subjects are all interrelated; process improvement may unexpectedly give better products and even new types of materials.

An essential thing to do at the beginning of process improvement work is to obtain a good knowledge of the cost sheet. This will indicate the places in the operation which show the most promise for technical concentration. It is easily understood that even though there are excellent opportunities for savings in some low-cost part of the process, that attention should first be turned to the high-cost phases that show possibilities for substantial reductions.

Suggestions dealing with a number of process development features follow. This discussion does not cover labor-saving devices or labor efficiency as such but is directed at the process.

Graphical Methods

The initial thing to do when a chemical engineer is attempting to improve processing operations is to utilize graphical and statistical methods for achieving maximum output[1]. It is assumed that operating standards to provide the foundation for satisfactory production are in effect. In order to intelligently control performance it will be necessary to develop the proper data regarding present operation behavior; this topic includes determining both the uniformity of output and product. Charts may be used to maintain maximum output by locating equipment unit, shift and other periodic fluctuations. The latter may be eliminated before advancing to process development investigations[3].

Full use should be made of statistical methods to improve chemical processes. This type of quality control can be used to decrease process variations and to foretell coming troubles[4].

Available Information

All available information and data relating to the processes should be used. Effort can be directed toward finding the facts developed in previous investigations and coordinating them with current practice in order to insure that everything of a constructive nature is being put to work. This means to apply all of the available knowledge about how to get the most out of the operation. In the case of processes which have been operating for some time there is a fund of experience available that may be ignored or overlooked due to changing personnel or other reasons. A perusal of the original process investigation, literature studies and utilization of data gained from past experience will give a good background.

It may be difficult to dig out all the data from the past because of poor records and it is usually the case that there are opinions present to be differentiatd from facts. Discouragements may occur at this point to those initiating work on process improvements because of confusion or lack of understanding but persistence should play a strong role here.

Off-Quality Product

Losses in yield that occur in the course of normal plant operation are subject to analysis and correction. The cost significance of this topic is well recognized by operating people. A constructive plan of action on this subject has recently been described[6].

A good accounting should be made of the yields throughout the various process steps. The yields are then determined regularly at these places in the process. A breakdown can be made later between intermediate points as necessary. The greatest losses should be corrected first.

Improve Maintenance

Proper maintenance considered broadly in all its component parts can achieve tremendous improvements in yield, output and quality[7]. The correct equipment that stands up against wear and tear contributes greatly to above-average volume of output. Interruptions to operations and miscellaneous gremlins contributing to contamination, poor quality, and so forth, come from faulty maintenance. A program for planned maintenance has been proposed recently[8]. After establishing suitable inspection schedules, keen head work can devise and provide preventative maintenance. The latter is based on anticipating troubles that are bound to happen. Keep duplicates of pipe and fittings that corrode badly on hand so that they can be installed quickly without delays. Better still, obtain and install piping and fittings that will not corrode.

Investigations should be made in order to avoid repetitive maintenance. Fragile equipment that breaks frequently should be changed. Self-sealing pumps should be installed to replace those that require constant service. Repeated failures of retort tubes caused by overheating in one place should be corrected by changing position, and so forth.

Cut Yield Losses

Elimination or reduction of off-quality is a simple but fruitful source of increased output. Improved control of equipment is important in helping to achieve this objective. Attention under this heading is given to making process changes which will prevent degradation.

Careful handling will increase the amount of first-grade material produced so, of course, the first thing to do is to correct faulty handling by operators. Opportunities are present for changes in process which will reduce materially the amount of inferior product made. Reducing the number of required handling steps is best achieved either by simple common sense or else by bold imagination that leads to real short cuts. Seeking changes which permit more careful handling of the product may have a prominent place on all process programs.

Process sensitivity is one of the outstanding factors in development work but its significance is not fully under-

stood by all working in the field. There are several degrees of freedom with regard to the time, concentration, temperature and pressure variables in which a process operates. Certain combinations of these conditions are much more sensitive to small changes than are others; a disproportionate number of quality defects results from the former. As there are always bound to be fluctuations of some order of magnitude the combination that will give the best possible product uniformity can be sought. Experiments should therefore be carried out to find ranges in temperature, concentration, and so forth, in which the material can be processed uniformly and economically. They can usually be found. Furthermore, close operating limits have sometimes been established with the objective of improving yield or quality which are expensive or difficult to maintain. Changing the range of conditions may avoid the necessity for such extremely close limits.

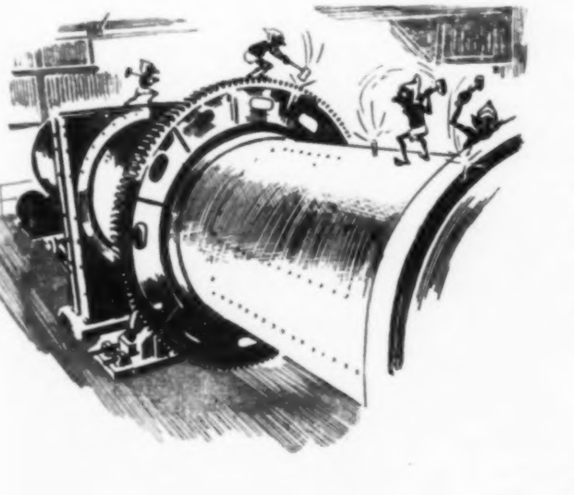
WHAT CAN BE DONE TO IMPROVE PROCESSING OPERATIONS

- Use graphical and statistical methods for achieving maximum output.
- Insure that all available information and data are being used.
- Set up a program for cutting yield losses.
- Improve maintenance procedures.
- Eliminate or reduce off-quality product volume.
- Find the optimum purity of process reagents.
- Determine the best process operating conditions.
- Better catalyst type or use.
- Install automatic control instruments.
- Improve sampling and analytical procedures.
- Shorten reaction times of batch processes.
- Increase speed of equipment.
- Raise concentration of solutions.
- Develop methods for using lower-cost raw materials.
- Utilize waste more efficiently.
- Install improved equipment units.
- Modify process to increase output by adding inexpensive equipment.
- Eliminate or combine process steps.
- Change to continuous operation where feasible.
- Use improved materials in process and construction.
- Seek a new viewpoint on the process.

Purity of Raw Materials

Optimum purity of process reagents should be determined. The proper standards are then established and put into practice. Examples exist where some unrecognized material, present in extremely small amounts, has an important bearing on the operation of the process. Systematic experiments along this line of essential material evaluation can be very revealing, and can be put to good use in improving yields.

Impurities play a different role when it is found that materials present in minute amounts and previously considered to be without influence are essential in obtaining good yields from chemical reactions. Large-scale experiments have been made in many chemical process industries in which great care has been taken to purify all the reagents with end results that not only showed no improvement but



in some cases were disastrous because unknown impurities were contributing to the successful yields.

A test was made some years ago in which all the ingredients used in the manufacture of rayon were of "C. P. quality." The resulting yarn was almost impossible to process in the usual manner for reasons that were entirely unknown at the time. Subsequent research established that materials present and considered to be impurities were vital to successful operation.

In general however, the starting materials and intermediates should be pure. Chemical synthesis is hard enough with pure materials; the presence of impurities results in complicated and puzzling situations.

An alternative possibility for investigation is illustrated by the case that occurred not long ago. A poor yield of a phenol derivative accompanied by excessive tar formation was encountered in a chemical plant. Considerable time was spent without success in an attempt to work out methods for purifying the reagents in the belief that this would help the yields. Later it was found that the use of an entirely different procedure for precipitating the final product gave a marked improvement because the sensitivity of the reaction had been changed.

Operation Conditions

Determine the best process conditions from a yield and quality standpoint. The current standards for operation are not always the best. It may be thought that the possible variables have been fully evaluated but this is not always the case. Although the present conditions have been established as a result of investigation and experience, some changes from the initial procedure will undoubtedly be in effect and in numerous cases there will be new knowledge available which makes it worth-while to carry out new tests.

Chemical process experiments in which the time, temperature, place and method of addition of reagents, and so forth, are varied are a fruitful source of important findings. Systematic approaches are best in this class of

work, although it is well to first spot the field by making a few broad changes. This will aid in locating the areas for intensive attention.

These experiments can be initiated by changing one variable, such as temperature, from present practice and then testing a range of different time cycles. Care is needed to provide the proper controls in any one experiment by only changing one variable at a time. However, the maximum final benefit will generally come about as a result of several process changes. All of these tests cannot be carried out on a plant-scale because of interference with regular operation. Those that cannot should be evaluated first in a pilot unit.

Catalysts

The use of better or improved catalysts in chemical operations gives remarkable results with regard to increased process output and lower cost[8, 9]. The method for using the

catalyst is also very important. Developments in the petroleum refining industry, such as use of fixed or moving bed catalysts and the use of circulating, or "fluid" catalysts are of particular interest.

In initiating work on the subject, the chemical composition of the catalyst may receive first attention and the imagination given free play. The way in which the catalyst is supported can be most significant as the base may be used to present more catalyst surface. The physical form of the catalyst plays an important role.

Sometimes two catalysts are employed simultaneously with effective results. The presence of the second material gives an accelerating effect and perhaps markedly reduces the cost of one expensive reagent. The proper reuse of catalysts should not be overlooked.

Control Instruments

The installation of automatic control instruments is a most important means for improving the yield and uniformity of output of many process operations. In addition to improved quality and yield are accompanying benefits in cost. Specialists can recommend controls which will achieve significant improvements in efficiency and yield. The instruments will be continually on the job and can be accurately set for fine differences. Instruments serve as integral and necessary components of many processes. Continuous flow control, liquid level adjustment, and temperature and pressure regulation are some of the best known examples[10, 11, 12, 13]. Each process step is studied to find the significant variables for control.

Most recent processes are designed to make the maximum use of instruments. However, there are constantly new developments so that it is always profitable to review what the possibilities are for additional automatic control. In the case of older processes the field is wide open.

Considerable publicity has appeared concerning the benefits obtained from instrumentation in the huge atomic energy war plants. It is worth-while for those working in process development to be familiar with what was accomplished in this connection.

Sampling Procedures

Improved sampling and analytical procedures and methods will result in greater output. Thus, the development of continuous analytical recording devices gives a basis for better control and consequent yield. There is an important field of process endeavor in finding ways to profitably use some of the newer control instruments[14]. If a batch mixing operation is employed, the development of a method of analysis that will more quickly indicate when equilibrium has been reached will increase production.

Some processes in effect today are largely based on precise methods of analytical control. Continuous process records that can be referred to at any time serve the dual purpose of permitting modification of the process at any given moment and also provide a chart for subsequent study and analysis.

Electronics can play an important role in control[15]. More rapid response to small changes is made possible.

Those working on improved processes can be alert to locate improved analytical methods, particularly those that will show the presence and amount of impurities. Continuous checking of current methods and reagents is of course necessary.

Shorten Reaction Time

Shortening the time of reaction in a chemical batch process is another fruitful line of effort. Opportunities frequently exist for such simple things as changing to larger pipe lines to enable quicker charging and discharging. The development of shortened reaction times will generally require adjustments in recipe and equipment to obtain satisfactory results. Working this out to a successful conclusion will involve a carefully detailed investigation of material and formula changes, frequent checks on operating practice, watchful inspection of equipment variations and then the usual time, temperature and change in addition experiments. The necessity for considering all of these things together makes the study complicated; it therefore is to be handled with great exactness.

Recourse can be had to the pilot scale operation in order to get at this matter in the most effectual fashion. To make such studies serviceable the correct relation must be established between small and large units, so that tests will be as reproducible as possible from one to the other. This involves special attention to agitation and heat transfer. The differences in mass heating and cooling between little and big reactors are frequently not easy to correlate. Exo-

thermic effects may be present to confuse the study. It is therefore necessary to have these considerations firmly in mind throughout the work.

After it is believed that a trust-worthy connection has been established between small and large-scale experiments, shorter time schedules which give the desired results are worked out in the pilot plant. These are then followed by plant scale tests. It is unusual for these tests to be successful in the first trials. Again look for the facts. Why? As one possible test, try to change the pilot operation to give the unwanted result found on the large scale as a means for determining where the discrepancy lies.

Equipment Speed

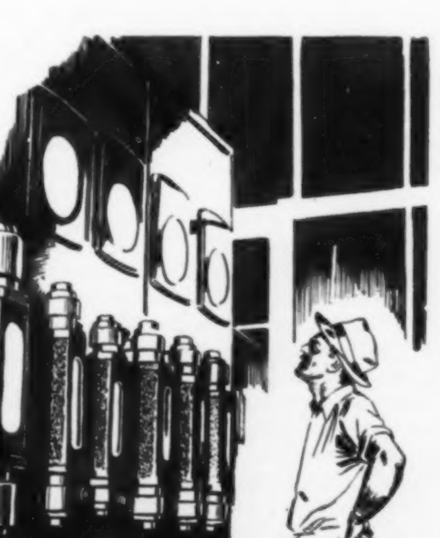
Increasing the speed of various pieces of equipment is the next thing to consider. It is easy to change gears (even though the desired ones never seem to be available) but unfortunately this is usually just the starting point of such an examination. The machinery must first be prepared mechanically so that it will operate successfully at increased speed. This may involve strengthening or other structural changes at various points. After this has been done and significant speed-ups are effective, it will be found that many things about the process do not proceed in the accustomed manner. Immediate problems will therefore present themselves for solution before successful high-speed operation can be achieved.

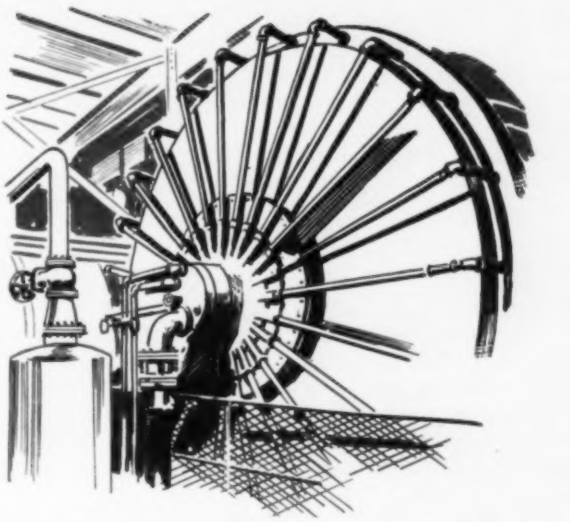
Sometimes the continuity of manufacture falls down, the yields are reduced in other ways, or the product quality may be adversely affected. The difficulties are immediately apparent and corrective effort can be directed toward establishing what the key ones are.

Solution Concentration

Over-all capacity gains can be achieved in many process steps by increasing the concentration of solutions so that the throughput of material is raised. Work of this nature is initiated by selecting places for testing the possibilities and then working out procedures where indicated.

Perhaps the concentration of one solution used in large





volume is maintained at a low figure because of high viscosity which limits the rate at which the solution can be pumped. Means should be sought for decreasing the inherent viscosity-causing characteristics of the material by product changes or, alternatively, some chemical may be found which will act as a viscosity depressant when added in small amounts. The equipment may be modified (insulation or heated jackets) to aid the use of a higher viscosity solution when there is a relation between temperature and viscosity.

Investigation somethimes shows that the solution concentration limits have been selected arbitrarily. In many such cases extensive experimentation is not required to effect a worthwhile increase. If however, trouble is encountered in subsequent steps as a result of this change, investigations directed at circumventing the difficulty should be made in order to obtain the advantages of increased concentration.

More efficient extraction of a material to be sent in dilute form to a recovery operation will increase the liquor concentration, thereby improving the capacity of the recovery unit and possibly the efficiency of recovery. Opportunities for such improvements can be sought in all possible operations including those where solvents are recovered.

Lower-Cost Raw Materials

Developing methods for using lower cost raw materials is a well recognized procedure that presents many opportunities for savings. When this part of the program is approached, it is usually found that the easy things have been done so that it is necessary to look beyond the obvious. In the event that cheaper ingredients are available but previous tests have shown that either process or quality problems result from their use, then an investigation is indicated in order to change the manufacturing conditions so that satisfactory results can be obtained. Preliminary experiments, made in the laboratory, when possible, can be conducted to establish the causes of the difficulties. The type of trouble encountered can be analyzed carefully to find the underlying reasons. The engineer should not be satisfied with the statement "it will not work."

A thorough survey of available market materials will often bring to light usable lower cost products that were not previously known. Vendors of raw materials may be contacted to arouse their interest in producing special grades at attractive prices.

Means of purification such as special filtration, ion

exchange, distillation, or other steps may be advantageously put in the process at the optimum place (found by experiment) to overcome quality problems caused by the change to a cheaper ingredient. Inexpensive material refining methods may sometimes be profitably carried out with lower grade essential materials before they enter in the process, thus enabling their use without ensuing difficulties.

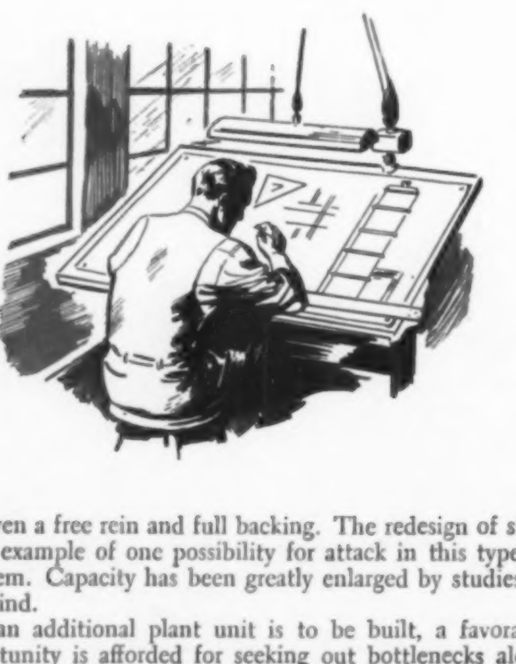
Utilize Waste

Efforts can be made toward utilizing waste more efficiently. Engineers may give consideration to finding attractive procedures for utilizing the waste made or for making it saleable. That is, a continuous program directed toward waste reduction may be maintained but in addition, attention may be given to finding ways for utilizing the waste that is produced. This may involve a study for obtaining ways for refining the waste material or of finding where to place it, or both.

Frequently procedures can be worked out for waste recovery. Developments in adsorption should be reviewed by those working in this field[18]. The recovery of material now lost to the air, or to the stream is worthy of special investigation. Ion exchange presents many possibilities.

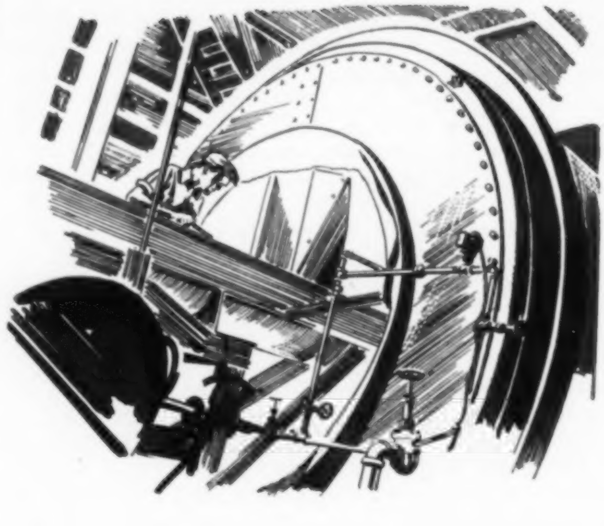
Improved Equipment Units

An investigation should be made to determine where new or improved equipment units may be advantageously installed in order to lower operating cost or to increase capacity. Attention in this investigation is properly first given to the bottlenecks. By improving the operation of one unit along the line so that it will produce more or by replacing it with a larger section, the over-all output of a series of equipment pieces may be raised significantly by relatively small money expenditures. Skilled and experienced chemical engineers can be very helpful in connection with the numerous phases of this class of work and should



be given a free rein and full backing. The redesign of stills is an example of one possibility for attack in this type of problem. Capacity has been greatly enlarged by studies of this kind.

If an additional plant unit is to be built, a favorable opportunity is afforded for seeking out bottlenecks along the line of present equipment and focusing attention on these points. There will usually be pieces of equipment in the process that are capable of greater output. It may be possible to increase present capacity by the addition of



miscellaneous equipment so that the full additional plant unit is not required. This procedure can be very effective in saving on new construction cost. Alternatively, process improvement studies may be combined with work on projected capacity increases so that significant savings are accomplished by the judicious application of process work at critical points.

If more capacity is required in the future, the technical group should make every effort to accumulate a wide fund of information that will permit the best possible choice to be made in arriving at the best process. Once a plant is built, it is much more difficult to make changes. Early experimentation permits recommended changes to be ready by the time management decides to build another unit.

Increase Output

The process may sometimes be modified to increase output by adding inexpensive equipment. For example, part of the operation which is now carried out in relatively expensive equipment may be changed to low-cost apparatus. Possibly two reactions occur at present in one vessel to give the final product. Separating the reactions into two components permits one phase to take place in cheap equipment thereby reducing the time required in the more expensive units now installed. Production output is greatly speeded up in this manner at relatively low cost. Numerous permutations of the various unit steps, such as drying, washing, mixing, extraction, precipitation, can be reviewed to determine opportunities.

It may well be that such alterations were not practicable or would not have resulted in significant economies when the process was first started in production. However, capacity increases achieved subsequently but prior to the present investigation now make such changes profitable.

Necessary predrying or prewetting steps can be handled first in one large inexpensive tank and then fed into equipment designed for more corrosive chemicals or perhaps for pressure operation. Washing or extracting processes should be separated from more complicated equipment in order to free the latter for large output of special reactions. The sizes of the units here may profitably be of different orders.

In thinking about process changes, such as are contemplated under this topic it is difficult for many to consider in the right perspective the radical new things necessary in some instances. They often sound far-fetched. The initial investment involved may look large but the opportunities for improvement are notable.

Combine Process Steps

Eliminate or combine process steps in order to increase output, simplify operation and decrease cost. One large unit may perhaps be installed to replace two small pieces with an over-all gain in capacity.

The manufacture of weaving beams by the rayon industry is an illustration of the reduction of process steps; an intermediate packaging operation is avoided in this way.

A complicated operation with many steps will provide a greater opportunity than does a simple process to devise improvements of this nature; for this reason the former may receive special study with this point in mind. The current process for the production of indigo is greatly simplified from that used in the early days of this synthetic chemical. Again experience and ingenuity count highly in making it possible to effectively accomplish process changes of this type.

The prime need for certain units may have passed or their functions can be successfully combined with other pieces of equipment. In fortunate cases, the bottleneck step in a process may be cut out completely by skillful development. This may be the optimum procedure to use in this type of development work, i.e., as the first attack try to remove the need for the most troublesome phase.

For example, in some processes a less costly or more efficient filtration procedure may be sought in order to achieve increased output; or the objective can be accomplished by eliminating the need for filtration by making changes at an earlier place.

Change to Continuous

Batch operations can be changed to continuous processes where feasible and economical. The initial attack on this topic may start with either a chemical or mechanical viewpoint, but both will be required in order to efficiently reach the objective.

The *Chem. & Met.* report and symposium on continuous processing (May 1945) covers this subject in great detail and should be studied by those interested. The question of which type of process (batch or continuous) is more efficient and easier to control has been reviewed. Economic comparisons of the two processes and the historical view of continuous process development are discussed. Continuous mixing and reactor equipment design and how processes are made continuous are covered.

In the matter of batch versus continuous operation, it is essential first to consider the economics involved[17]. It should not be assumed prior to the making of a suitable survey that large savings will result. The cost of continuous operation may be sufficiently great because of depreciation or investment return necessitated by large construction expense so that the equipment required cannot be justified on a basis of replacing the present batch units. Investigation sometimes indicates that certain complicated chemical reactions may never lend themselves to uniform continuous operation. If this appears to be the case, however, a challenge is presented to change or modify the reaction so that it can be made continuous.

A vapor phase continuous operation generally appears attractive at first glance when compared with a liquid batch reaction. There is the simple reservation that the former can be made to work. After the decision has been made to study the possibilities of vapor phase reactions, the usual sequence of laboratory and pilot plant studies will follow. More than usual attention from a cost study angle may be given to the findings. The guiding thought may not be what it is hoped the yields will be but what the tests have shown they will be.

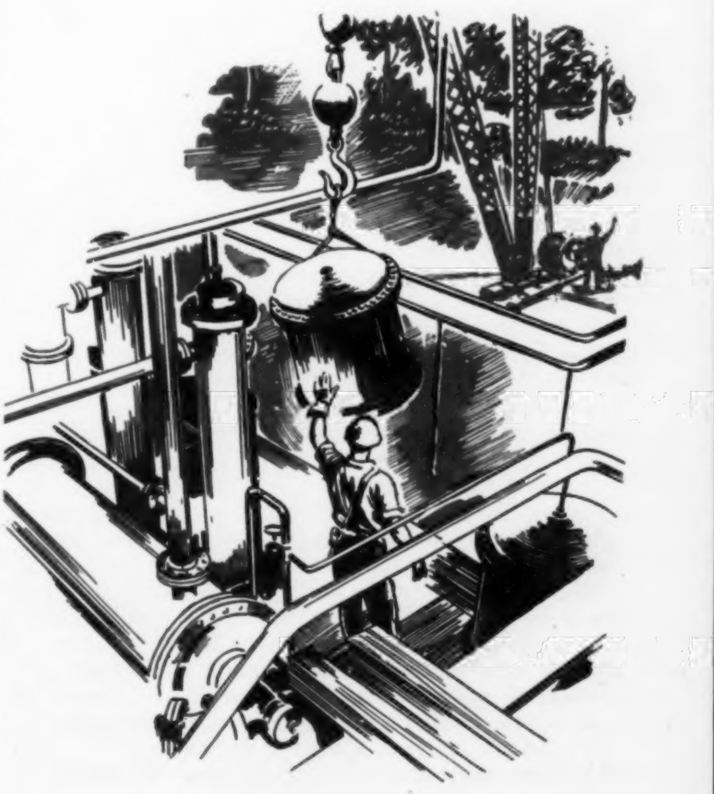
There is more than one type of continuous operation to consider. For example, the plan of having a thin film of material reacting on a rotating drum is a possible alternate for the screw feeder type to which materials are constantly added. A study of the processes and equipment used in other industries is an ever fruitful source of new ideas and methods in this connection.

In the study that takes place during the development of a pilot scale continuous operation, considerable data will result which will be applicable to the present batch operation. It is therefore worthwhile to keep the mind open for possibilities here and to capitalize on them as they become available.

Materials

The use of improved and new materials permit marked advances to be made in process technology. Various new materials become available constantly. Resins which will react more quickly are a good illumination. New inks based on fast drying resins make high speed printing feasible. Newly developed resins which react more quickly than conventional materials permit equipment to be designed and installed for producing laminates in a much shorter time than previous practice. Thus revolutions in hot plate equipment and the elimination of process components such as drying can also result from the adoption of the faster drying resins.

Improved materials of construction make it practical to effect many process short cuts. Stainless steel, of course, can be cited as the corner-stone for many processes which would not exist without it. Reference may be made to the literature dealing with corrosion resistance in order to gain ideas along this line[20]. How special materials solved corrosion problems at Oak Ridge is described in the literature[21].



New Viewpoint

A new viewpoint on the process itself may yield some far-reaching results. This involves passing from relatively simple changes to those that are very extensive. Take as an example the case where an organic solvent is used at some step of chemical product manufacture. A sequence of development studies might go somewhat as follows:

A. Change the process so that it requires the use of less solvent. Higher concentration of solution, fewer steps in the process, and lower losses are practicable examples.

B. Develop a more efficient (lower cost or one requiring less equipment) method for recovering the solvent.

C. Work out a procedure for using a cheaper solvent. Perhaps a low cost diluent can be added.

D. Add a refinement whereby solvent is recovered at a step in the process where it is now being lost.

E. Originate a means for using the organic solvent directly as it comes from the process so that recovery is not required.

F. Find a method for carrying out the process with water instead of an organic solvent. This will not only eliminate the cost of the solvent, but also such problems as safety, corrosion of metals, the need for special equipment, recovery, etc.

In many cases there will be several avenues of attack open in which to achieve process improvement. Time should be taken to think out the most profitable one to start on. Process development can be handicapped by a state of mind. People who are not willing to visualize the possibility of making important changes for the better should be removed instead of reasoned with. It takes less effort. An executive has stated that there are cases where he would prefer to start on a process improvement program with an entirely new crew who possess no inhibitions about what can be attempted.

Take the recovery operation of an essential chemical ingredient as a subject for discussion. This process can be improved by increasing the speed at which the units run, or by raising the concentration of the chemical in the incoming liquor, or there are possibilities for altering the initial chemical process so that less ingredient is used, thereby reducing the load on the recovery operation. Perhaps a special piece of equipment can be installed to take part of the load off the full unit; this will give an overall increase in output.

Certain men, often those with little formal education, have great mechanical gifts in inventing equipment changes and in refining machine details. Their abilities may go unrecognized unless time is taken to look for them; definite efforts should be made to use these people constructively. A little encouragement goes a long way here.

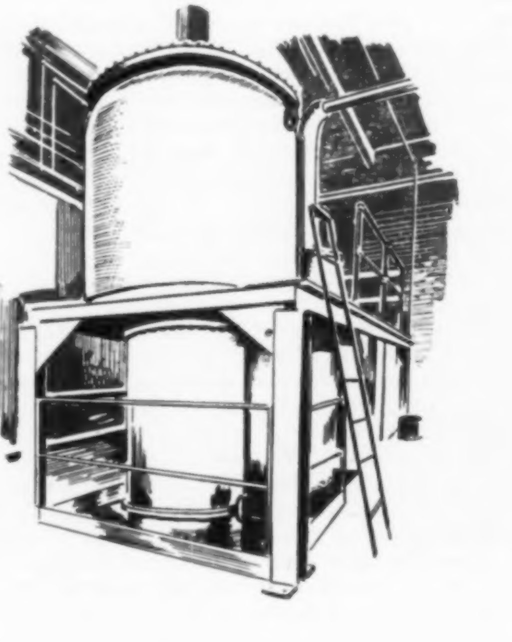
Reading about new developments, processes, technology and methods is very helpful to those interested in new ideas. A recent discussion on fluidization in chemical reaction tells how improved temperature control and heat transfer are achieved by this means. A few possible references along this line given to illustrate this thought are papers on Reppe's acetylene chemistry, the hydrolysis of lignocellulose, partial pressure processes and a new text on unit processes.

The above list of topics outlines a number of suggested approaches. It is not intended to be fully comprehensive but provides a starting point for those not well acquainted with the field. Economic balance must be kept firmly in mind in all process work. Reduction in costs should be made so that maximum earnings are made in unit time.

A recent article gives a detailed discussion of the guidance of process operation by the economic balance. Another article worth study presents a new graphical method for process economic analysis.

To be successful in this series of investigations, it is necessary to start with a logical, systematic, and thorough approach. Plenty of backing will be required from management and adroitness in obtaining the cooperation of plant personnel is essential. When it is realized by everyone that the objective of this work is to help all concerned build soundly for the future one milestone will have been passed. The success of the program then depends on aggressive men with skill and persistence.

The articles listed in the bibliography contain numerous references which pertain to the various subjects. Reference should be made to the standard texts and handbooks on chemical engineering, particularly to "Chemical Engineering Plant Design" by S. C. Vilbrandt, McGraw-Hill Book Co.



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Girdler construction crew sets up tower for HYGIRTOL *plant, which produces hydrogen of higher purity more economically than any other method.*

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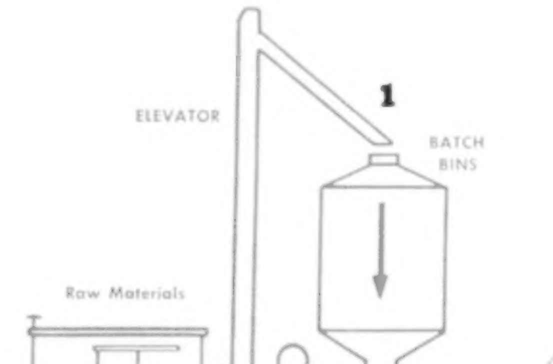
• G I R D L E R •

DESIGNERS, ENGINEERS AND CONSTRUCTORS OF GAS PROCESSING PLANTS

PICTURED FLOWSHEET

1 Batch house where raw materials for all fiber glass products are stored and mixed in a plant of the Owens-Corning Fiberglas Corp.



FIBER GLASS PRODUCTION

ALMOST daily new uses have been found for glass in fiber form ever since the early 1930's when it was first produced on a commercial scale in this country. At the present time Fiberglas is produced in more than 4,000 forms to meet the requirements of hundreds of different applications.

A brief description of the processes used in the plants of the Owens Corning Fiberglas Corp. is of interest. Fibrous glass in its modern version was first developed as a staple fiber and then shortly thereafter as a continuous fiber. The former is slightly the more complex of the two processes. A variety of glasses is employed including alkali-free and low-alkali soda-lime compositions. Small glass marbles are automatically fed at regular intervals to an electrically heated furnace. Molten glass discharges continuously through a spinneret. Directly below the orifice plate is a steam jet discharging high pressure superheated steam in such a manner as to seize the molten threads and drag them downward, decreasing their diameters. The individual fibers are projected downward through the path of a lubricating spray and a drying torch. They strike a revolving drum and are directed through guides and wound on tubes. After drafting and twisting to form yarns they are sent to weaving and textile fabrication.

The continuous fibrous glass process draws its filaments from an orifice plate, producing individual fibers. In this process a similar furnace is employed, but without the steam jets for drawing and attenuation. Fibers are led through an "eye" and then gathered, lubricated and put on high-speed winders. Yarn spun by the continuous process is then put through the finishing operations.

In the case of wool, batch cans discharge raw materials into the furnace. Molten glass is extruded and steam jets stretch the filaments while in the forming chamber. The Fiberglas wool is conveyed to packing department or to another department where it is fabricated into various forms.

CHEMICAL ENGINEERING

June, 1947

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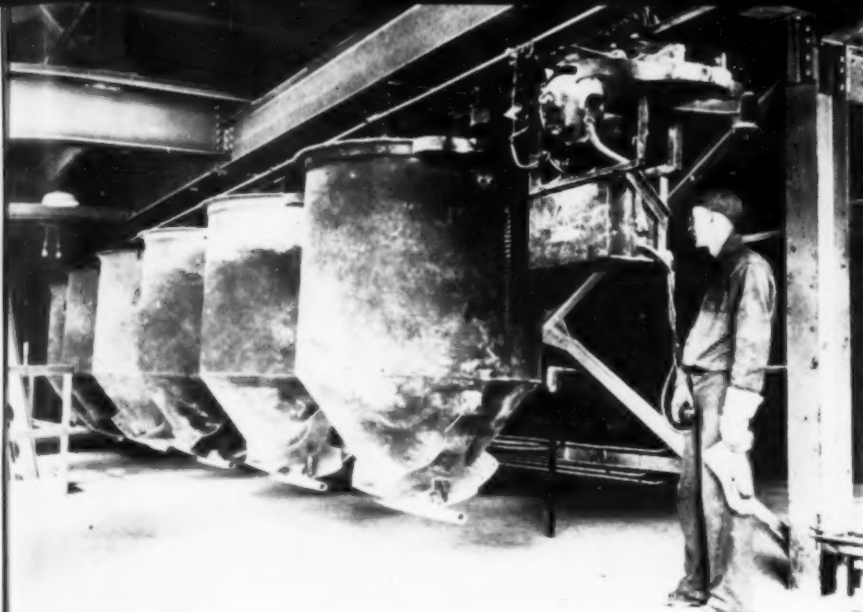
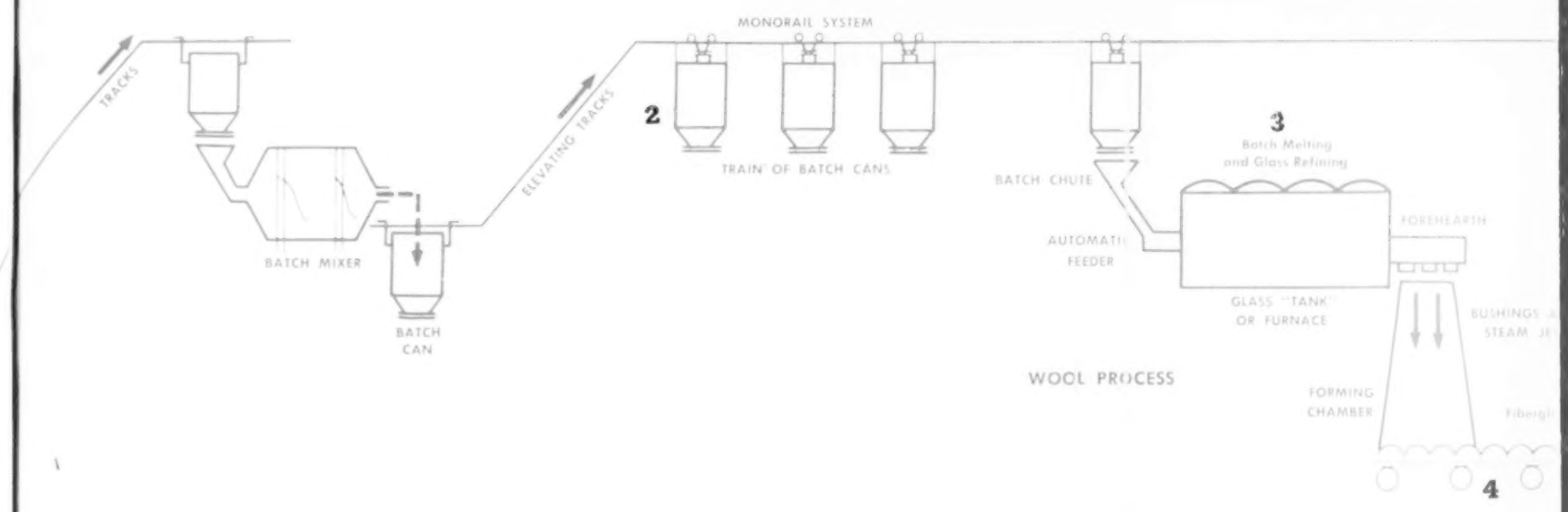


2 After a batch of raw materials is mixed it is put into a batch can and by means of a monorail system is transferred to the melting furnaces

3 In this furnace the batch—sand, limestone, and mineral oxides—is melted and refined

4 Molten glass is extruded and stear chamber. Here they are shown emer



7 Glass discharges from the furnace through a spinneret in form of continuous filaments so fine that they are almost invisible

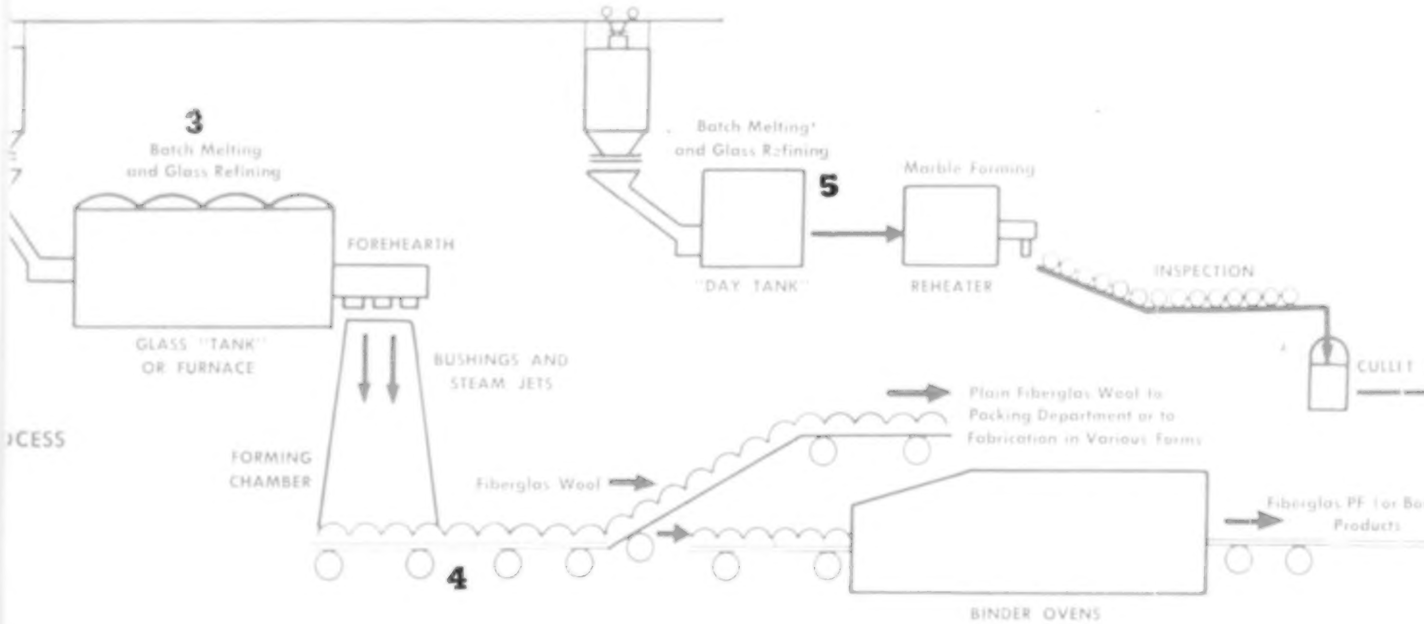
8 Fibers are gathered, lubricated and put on a high-speed winder. Here operator is winding more than 100 filaments on the winder

9 Twisting strands of continu tile fiber into yarns

d mineral

4 Molten glass is extruded and steam jets stretch the filaments while in the forming chamber. Here they are shown emerging from the chamber on a conveyor

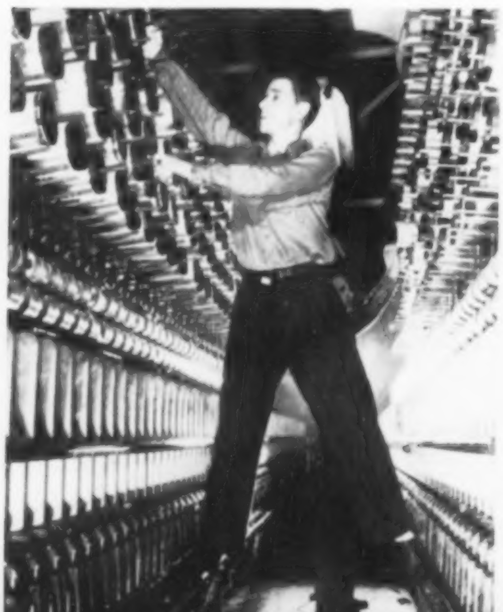
5 This furnace melts and refines r
reaches desired point glass passes t



CESS

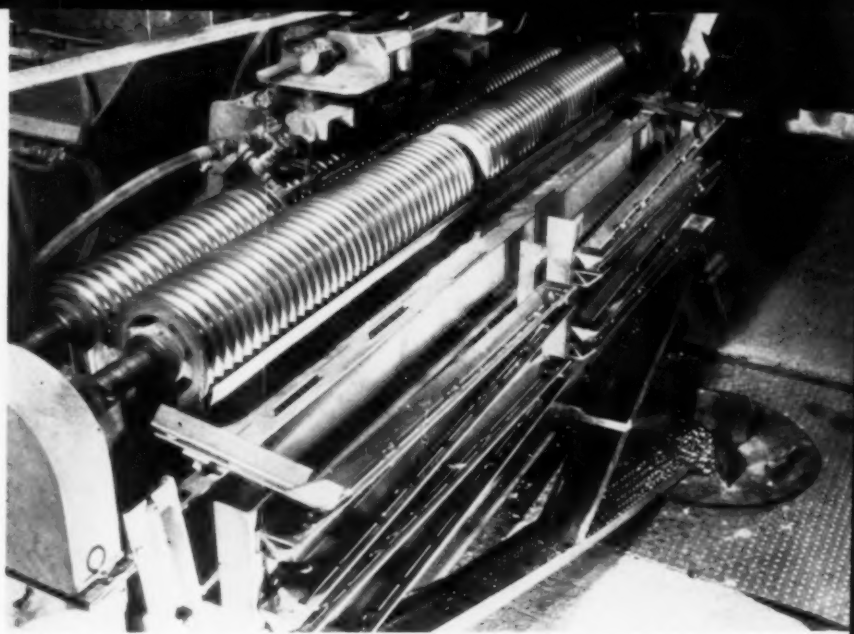
h-speed winder.
the winder

9 Twisting strands of continuous filament textile fiber into yarns



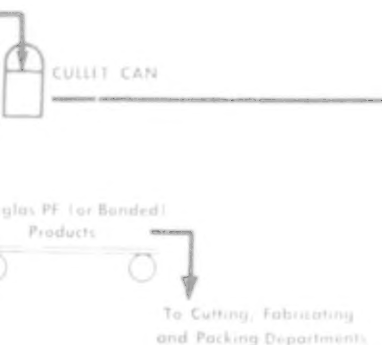
10 Tubes of continuous filament fiber glass yarn after all finishing
have been completed are ready to be woven into a fabric

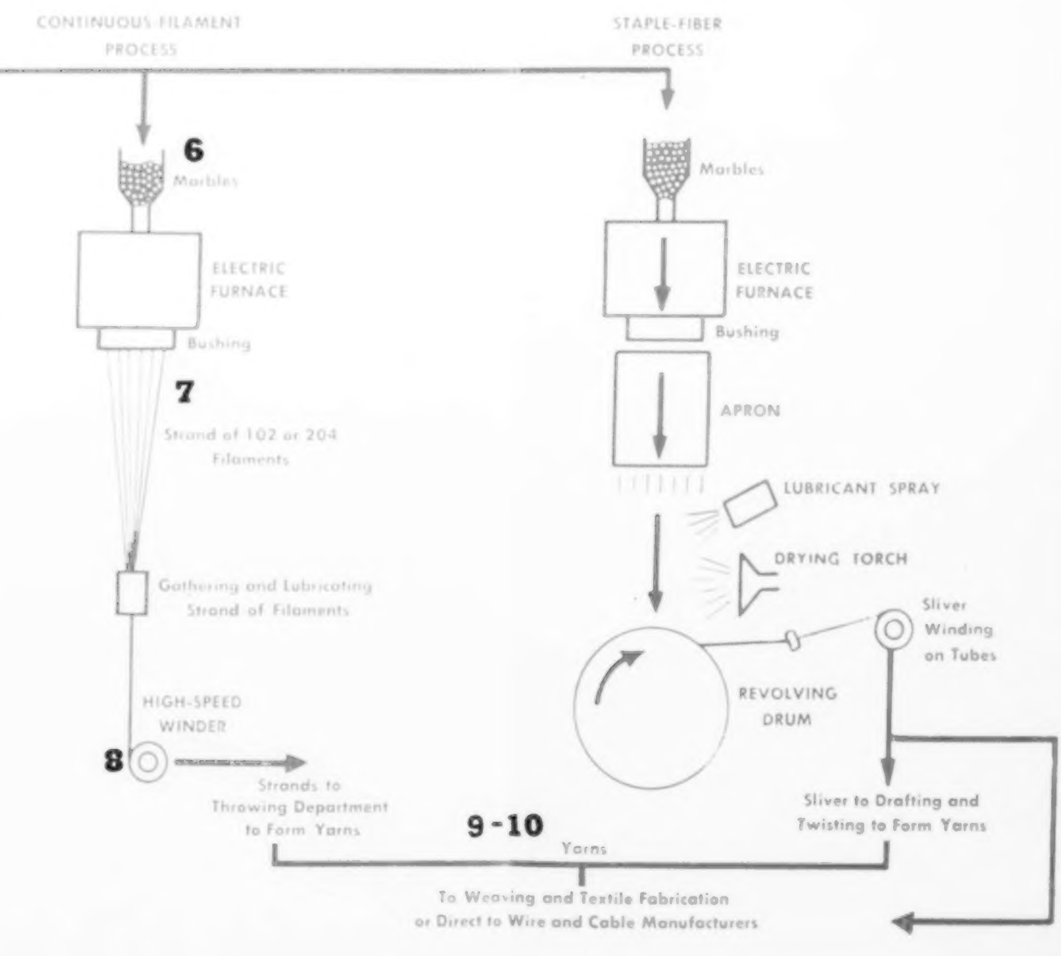
and refines raw materials. When viscosity of molten glass glass passes to reheater and marbles are formed



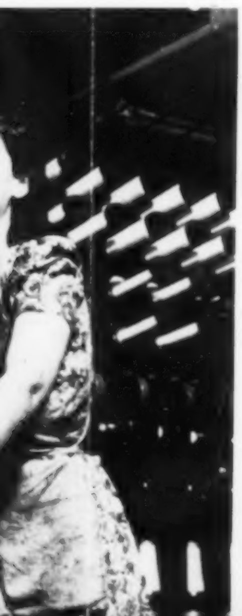
6 On leaving the reheater the molten glass is formed into marbles. They are automatically fed at regular intervals into electric furnace

TEXTILE PROCESS



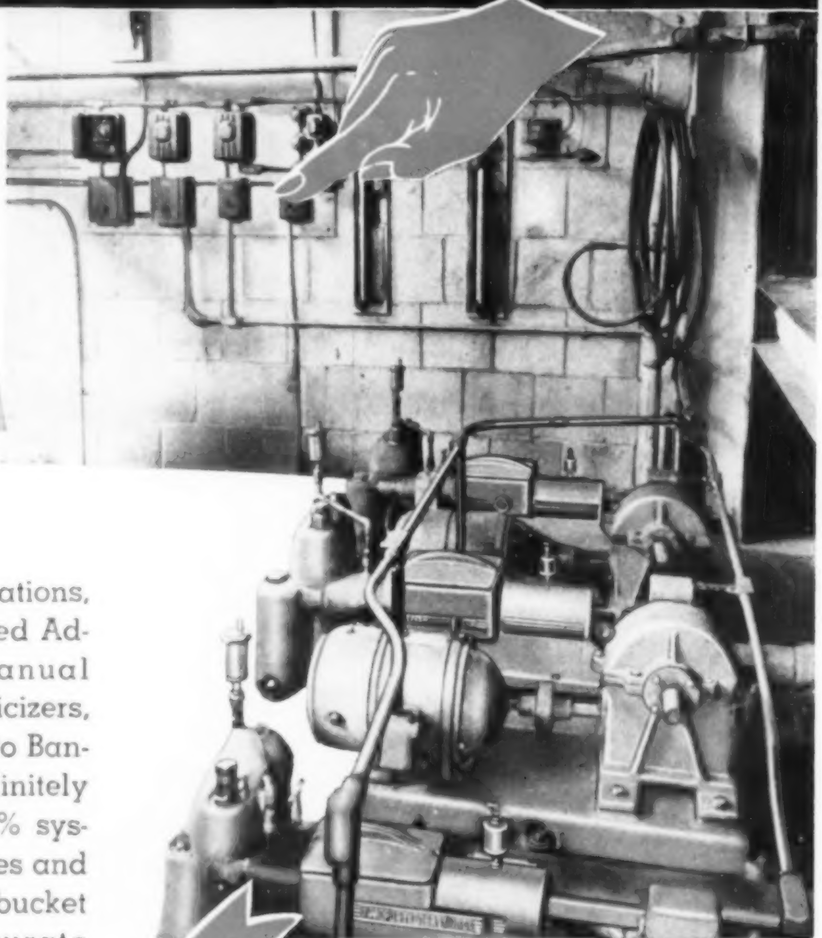


all finishing operations
ric



"Push Button" COMPOUNDING

Automatic Repeat Batch Addition to Banbury Mixers



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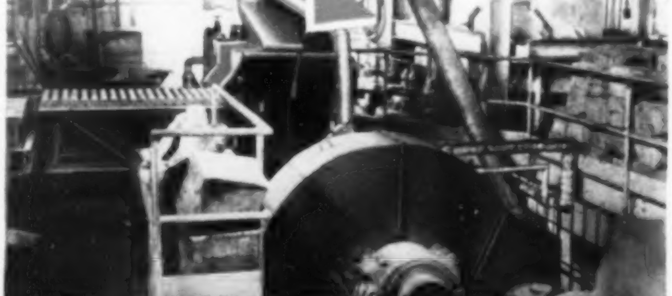

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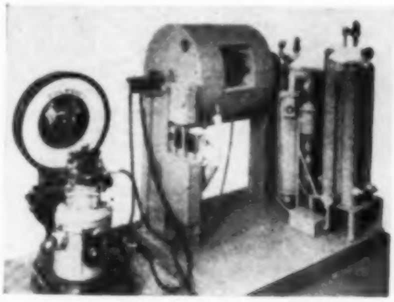
PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

1. Compounding Process

COMPOUNDING of thermoplastic materials is being carried out successfully by a new process originated by engineers of the Hungerford Plastics Corp., Murray Hill, N. J. The process, which has been in development for four years, including a two-year period of quantity production, is now available for licensing on a royalty basis. The equipment using the process is being manufactured under the name of Plastimaker in 40, 150, 300, 600 and 1,000 lb. capacities and is said to be suitable for use by molders and extruders of a wide range of cellulosic and vinyl products.

The illustration shows the 40-lb. laboratory size Plastimaker. In this



40-lb. laboratory Plastimaker

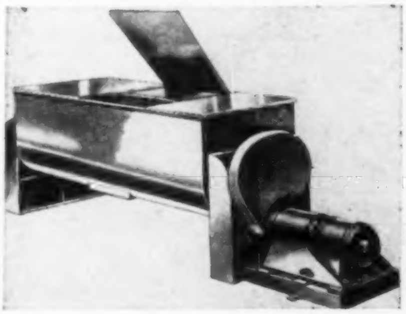
process practically all materials requiring the addition of a liquid plasticizer can be treated without the use of solvents and slurries, or the usual steps of combining the materials into a fused mass, mechanical working, hardening and grinding. Instead, the flake or resin together with dye, pigment, stabilizer, extender and filler, are charged into a compounding chamber which is rotably mounted. During the rotation the plasticizer and other liquid additives are spray-injected into the chamber, after which the material is dehydrated by filtering hot air through it as the chamber continues to rotate. The material remains as a powder throughout the process and is then ready for feeding to standard molding or extruding equipment.

As advantages the process is claimed to give superior quality products through better plasticizing and dispersion; lower production and power cost; better material economy through use of a higher percentage of filler; better flexibility of formulation; and higher overall economy.

CONTENTS

2. Horizontal Mixer

A LINE of horizontal mixers and blenders of both single- and multiple-arm types, suitable for the mixing and processing of a wide range of materials from dry powders to heavy viscous slurries and pastes, has been introduced by The H. W. North Co., Erie, Pa. These mixers are available in plain or stainless steel construction, with mixing chambers jacketed when required for either heating or cooling. They are individually designed for each particular application for batch, automatic or continuous operation, as needed. The manufacturer also supplies special designs for processing materials under vacuum or internal pressure. Mixers with both tiltable and stationary mixing chambers are available, the agitators being of both multiple ribbon and paddle types, turning on anti-friction bearings mounted and sealed separately from the trough end walls. Sizes range from 850 cu.ft. working capacity down to 1.6 cu.ft., with horsepower requirements ranging from 75 down to ½.



Horizontal ribbon type mixer

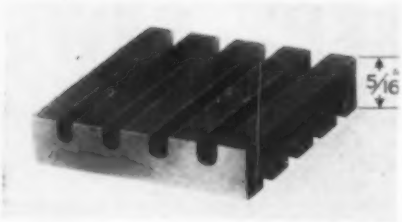
FOR MORE INFORMATION

See Reader Service Coupon on pages 153-154

3. High Vacuum Gage

WHAT IS said to be an entirely new approach to vacuum measurement is employed in the Skanascope, a new high vacuum gage designed specifically for production work and distributed by

Fluorescent type high vacuum gage



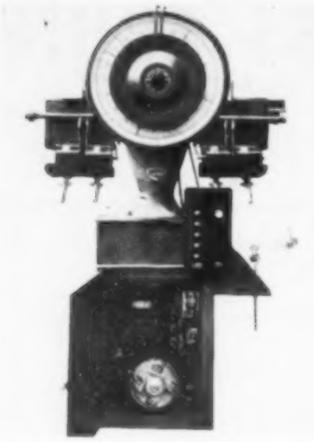
Isomode pad for vibration absorption

Distillation Products, Inc., 755 Ridge Road West, Rochester 13, N. Y. The new gage makes vacuum measurements by indicating through color on a fluorescent screen, instead of the usual needle and scale. The gage operates continuously, thus enabling the operating status of a vacuum system to be determined at a glance at the color screen at any time. Connected directly into the vacuum system, without need of calibration or zero setting, the device monitors the total pressure of permanent and condensible gases in the system and compensates for the effect of temperature changes on the pressure. Since it is automatic in operation, it may be permanently plugged into a standard electrical receptacle, since no current will flow until the system is under vacuum.

A development of the Skaneateles Mfg. Co., the device is responsive to the total number of molecules present in a unit volume of the evacuated space. The color of fluorescence produced in its special tubes is an indication of the total pressure and an operator can readily determine whether the pressure is in the range of 30 microns, 60 microns, or 600 microns. Under normal conditions, the tube is said to have an operating life of 1,000 hours or more.

4. Weigh Batcher

ANY NUMBER of free-flowing ingredients can be weighed to predetermined weight by means of an improved automatic weigh batcher developed by the Conveyor Co., Los Angeles, Calif. Designed around a dial scale, the batcher uses a single photoelectric cell to activate mechanisms which open and close bin gates. Movable contact lights can be placed at any point on the dial to correspond with predetermined weights. These shoot a light beam to the photo-cell as the hand of the scale sweeps around to each contact point. This leads to the closing of the gate of the bin which has just discharged and at the same time opens the gate of the next bin. The process is repeated automatically until all materials have been weighed out, the number being practically unlimited. At the end of each



Automatic photo-electric batcher

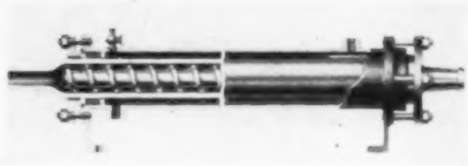
cycle the equipment automatically resets itself, leaving it to the operator to push a button which repeats the cycle. Operation is extremely rapid, in one case completing a four-ingredient batch in 22 seconds.

5. Vibration Absorber

ALL KINDS of machinery, it is claimed, can be mounted without hold-down bolts, concrete mats or grouting by placing on MB Isomode pads, which are neoprene pads 18 in. square and $\frac{5}{16}$ in. thick, produced by the MB Manufacturing Co., New Haven 11, Conn. It is claimed that the pads serve as self-adjusting shims that compensate for variations in floor surface and that they absorb all frame and foundation stresses normally present during the operation of rigidly attached machines. In addition to saving installation cost and permitting immediate relocation of equipment, the pads are claimed to reduce noise greatly with all kinds and sizes of machinery.

6. Dehumidifier

A PACKAGE-TYPE air-drying unit, introduced under the name of Dry-Namic, is being supplied to industry by Cargocaire Engineering Corp., 15 Park Row, New York 7, N. Y. This unit, originally developed for the preservation of ship cargoes through dehumidification, has been modified for industrial use and is available in ten sizes for treating from 20 to 13,750 cu.ft. of air per minute. The unit is of the type employing dual solid adsorbent towers, one of which operates on the humid air to remove its moisture, while the other is being reactivated with heated outside air. The latter is heated with electricity in the smaller units, or with either electricity or steam in the larger units. The machine operates automatically, without attention, running



Duriron heat exchanger

Kinetic portable revolving-drum mixer

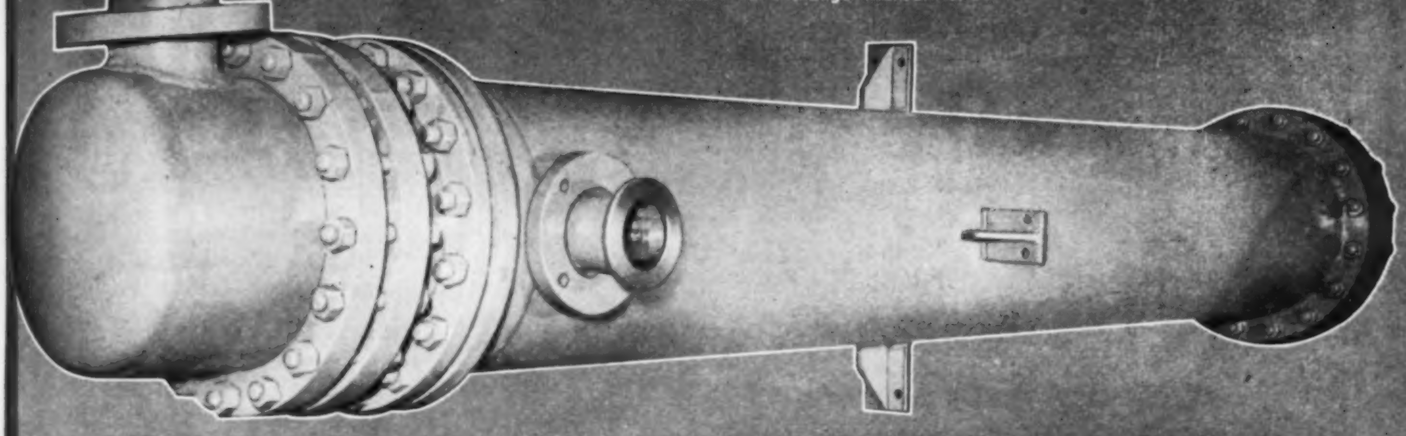
when dehumidification is called for, and shutting down when it is not needed. Changeover from one absorption tower to the other is accomplished by an automatic valve and control system.

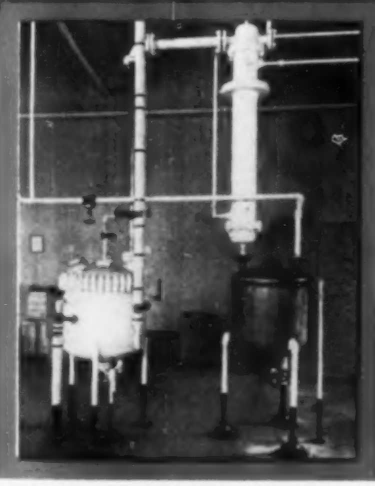
7. Portable Mixer

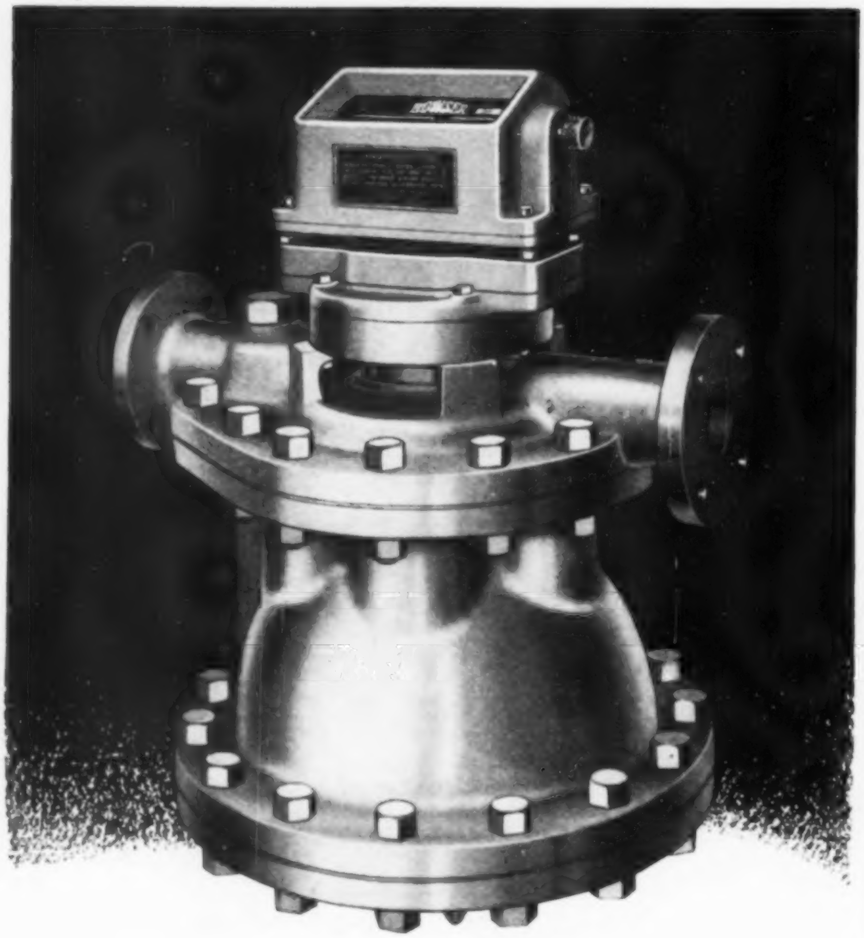
NEW MIXING principles are said to be employed in the portable, 3 cu.ft. Kinetic mixer introduced by The Foote Co., Nunda, N. Y. The mixer incorporates a revolving drum and three stationary blades, powered by a 12-hp. gasoline engine, or with an electric motor, if desired. The unit is mounted on pneumatic tires and weighs approximately 1,500 lb. Designed to handle not only construction mixes such as concrete, but also ceramic and chemical mixes, the device is said to turn out as many as two batches per minute, depending on conditions and the materials being mixed. It is equipped with a pump for introducing liquids at a maximum rate of 8 gal. in six seconds. The pump is controlled by an automatic timer which closes the hand-operated control valve when the desired gallonage has been introduced.

8. Duriron Heat Exchanger

FOR USE where corrosion resistance is desired, the Duriron Co., Dayton 1, Ohio, has introduced the new Durco No. 4 heat exchanger which is a new design, said to be especially suitable for the efficient cooling or heating of small quantities of corrosive solutions over a wide temperatiure range. The





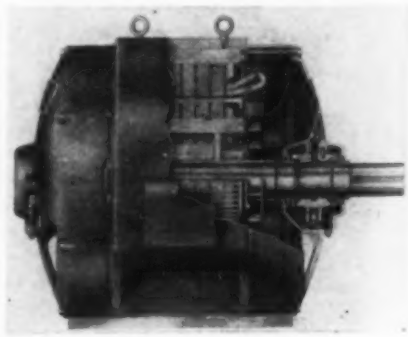


No. 4 size, first of the new line, handles an acid flow of from 4 to 14 g.p.m., with a heating capacity up to 155,000 B.t.u. per hour, using 75 psi. steam and an inlet temperature of the liquid between 70 and 130 deg. F. The cooling capacity is said to be up to 90,000 B.t.u. per hour, based on 100 deg. F. mean temperature differential. The company is now developing larger sizes. However, the present size can be used for a wide variety of heat exchange problems since the unit can be readily connected to similar units in either series or parallel.

In the new exchanger the features include separation of the steam or coolant from the corrosive agent by means of a Duriron tube; vertical or horizontal installation; no packing against the corrosive solution; and ability to remove parts without disturbing the steam or coolant inlet and outlet connections.

9. Heavy Duty Motor

For large loads in the range from 100 to 1,000 hp. at 1,800 r.p.m. or lower speeds, the Electric Machinery Mfg. Co., Minneapolis 13, Minn., has introduced a new line of heavy-duty, squirrel-cage induction motors in drip- and splash-proof construction. These

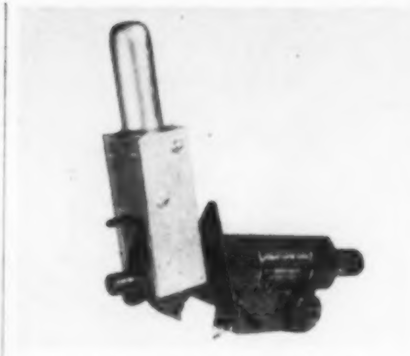


Heavy-duty steel induction motor

motors have fabricated steel frames with access plates designed to facilitate inspection and blowing out. The sealed bearings can be cleaned and refilled without motor disassembly. Double-end ventilation is provided by a blower on each end of the rotor. The motors are of the normal-torque, low-starting-current type for across-the-line starting.

10. Heated Valve

Electric heating devices are applied to valves of various types and sizes, or may be installed on valves furnished by the customer, by Sta-Warm Electric Co., Ravenna, Ohio. Several kinds of valve, including wheel-type gate valves, special gate valves for molasses and similar viscous materials,



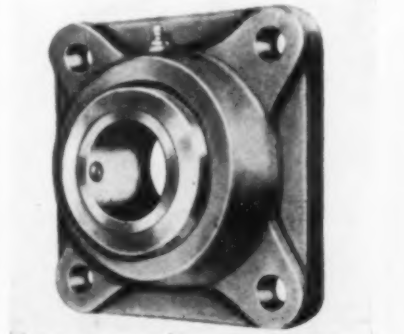
Electrically heated molasses gate valve

and bibb faucets, can thus be heated to prevent freezing of the contents and are said to be especially suitable for use as shut-off valves which cannot be heated in steam-jacketed pipe lines. In all cases the heating element is cemented directly on to the valve and is then inclosed in heat insulation and a sheet metal housing. An automatic adjustable thermostat, either factory-set or designed to provide a range of temperatures, automatically maintains the desired valve temperature. The illustration shows a special electrically heated molasses valve equipped with an adjustable thermostat for use on melting tanks or at the ends of pipelines for dispensing melted compounds. This particular valve is quick opening and closing, and substantially prevents drip.

11. Flange Bearing

Known as the SC ball-bearing flange bearing, a new unit announced by the Dodge Mfg. Corp., Mishawaka, Ind., incorporates a self-aligning ball bearing supported in a flange housing suitable for mounting against vertical or horizontal frames and supports. The deep-groove bearing has an improved labyrinth seal. The company has also introduced a new steel-frame ball-bearing take-up for conveyor service which includes a ball-bearing inner unit, inclosed in a cast iron housing provided with ways on each side for supporting guides. A welded steel frame is provided in which the bearing unit slides,

Anti-friction flange bearing

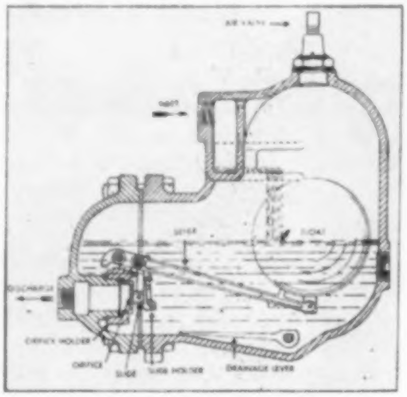


FOR MORE INFORMATION
See Reader Service Coupon on pages 153-154

held at the desired location by means of an adjusting screw. The unit is available for shaft sizes from $\frac{3}{4}$ to $2\frac{7}{16}$ in.

12. Slide Valve Trap

DISCHARGE of condensate in a continuous stream, varying in rate with the rate of accumulation in the trap, is claimed for a new line of float-operated steam traps announced by W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn. The mechanism consists of a float which in rising or lowering moves a slide valve over an orifice. Flow is continuous and uniform and it is claimed that a smaller trap can therefore be used for a given discharge. The trap body and cover are made of cast steel, the cover carrying the slide valve, lever and float which are the only moving parts and are thus readily removed for inspection. The valve slide and orifice are made of stainless steel and



Cross section of float-operated trap

the float ball of polished stainless steel. A simple drainage lever is provided to raise the float, opening the valve and permitting drainage of condensate from the body. If desired, a thermostatic air relief can be provided.

13. Spray Welder

A UNIT combining the features of a spray metallizer and a welder has been announced under the name of Spraywelder by the Wall Colmonoy Corp., 19345 John R, Detroit 3, Mich. Developed for use in conjunction with the company's Sprayweld process, it is used in applying Colmonoy hardfacing alloys (or other powdered compositions) by metal spraying, after which the gun is used as a conventional

welding torch to fuse the sprayed overlay of powdered alloy to the base metal to obtain a fused bond, identical with that obtained when the same alloy in rod form is applied by acetylene welding. The device is said to be both simple and dependable. The unit consists of the gun, all necessary hoses and connections. The hopper for powdered metal and the carburetor are combined in a single unit. In addition a panel to hold all equipment is provided.

14. High-Lift Truck

ADVANTAGES to be gained from ability to lift to a height of $66\frac{1}{2}$ in. (or $70\frac{1}{2}$ in. depending on model), are now available in the hand-guided, electrically operated lift truck known as the Worksaver, produced by the Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia 24, Pa. As the accompanying illustration shows, the machine is equipped with a lifting platform which can get under a 7-in. skid and hoist it to a considerable height above the floor for stacking or picking up from elevated docks, racks or tailgates. The two models both have a capacity of 4,000 lb., one lifting to a $66\frac{1}{2}$ in. height, the other to $70\frac{1}{2}$ in. Both units are said to be highly maneuverable, capable of taking a right-angle turn within 91 in., and requiring only 54-in. aisles. A circle of 95 in. radius can be swung and the units can climb a 9 percent grade under their own power. The usual features of power for all operations except steering are provided.

High-lift platform type Worksaver

15. Eight-Way Pallet

A LIGHT-WEIGHT steel-wire pallet of the eight-way type, said to be capable of supporting more than 20 tons weight without failure, has been introduced by the Pittsburgh Steel Products Co., Pittsburgh 30, Pa. The pallet is welded throughout into a rigid one-piece unit which, if desired, can be provided with wire mesh sides to enable small packages to be carried. In this case the sides are designed to fold

Light-weight steel wire pallet

down when not in use for ready stacking. Furthermore, the sides are readily removable for converting into a regular platform pallet which may again be reconverted to the container type when desired. The pallet comes in two sizes, 36x45 in. which weighs approximately 54 lb., and 48x48 in., which weighs approximately 72 lb. Other sizes can be furnished at slight additional cost. Also, lighter duty pallets are available.

16. Vacuum Leak Detector

Both simplicity and sensitivity are stressed in a new instrument for detecting and locating leaks in vacuum systems which is being offered by Davis Emergency Equipment Co., 98 Halleck St., Newark 4, N. J. With this device it is said to be unnecessary to shut down the vacuum system in order to detect a leak. The operating principle is simple. A heated wire, housed in a metal chamber which is part of a wheatstone bridge circuit, becomes slightly chilled when a vacuum is pulled on the chamber, thus upsetting the balance of the bridge and causing a needle to rise on the scale of the meter. The instrument is said to be capable of registering a leak as small as the equivalent of 0.006 in. of water, which causes a $\frac{1}{8}$ in. deflection of the needle on the scale. It is claimed that the instrument can be used not only on production equipment, but also in the detection of leaks when checking welded seams or joints and equipment under pressure. The unit is a portable battery-operated model of small size,

Vacuum leak detection meter

furnished with a short tube having a rubber suction cup which is applied at the point of detection. This tube is connected with the instrument and when the rubber suction cup covers a leak in the tested equipment, the needle on the meter rises.

17. Direct-Reading Spectrometer

Direct readings, made rapidly and automatically, can provide analyses of various metal alloys in the new Baird Associates-Dow direct reading spectrometer developed by Baird Associates, University Road, Cambridge 38, Mass. The new instrument eliminates the necessity for photographic and developing equipment and thus prevents the errors encountered in ordinary spectographic work, due to variations in film emulsion. Only one technician is required to operate the instrument since the source, the spectrometer and the measuring system are integrated into one compact unit. At one commercial alloy plant using this instrument, samples are said to be run currently at a rate of 4,000 per month, representing approximately 20,000 quantitative determinations.

Direct reading spectrometer

Individual spectrum lines necessary for analysis can be isolated even in the complex iron spectrum, and their intensities measured with electron multiplier phototubes. The output current of the tubes charges a capacitor which, at the proper time, discharges into a meter reading directly in percentage concentration of the alloying and residual constituents. An analysis time of less than 2 minutes is claimed for each sample.

Equipment Briefs

18. According to Sorenson & Co., 375 Fairfield Ave., Stamford, Conn., it is possible with a new line of voltage regulation units known as Nobatrons to provide regulated d.c. voltages at currents and stabilities that were previously available only with batteries. These devices are available in six standard models to produce amperages of 5, 10 or 15 at voltages of 6, 12 and 28, using 95 to 125 volts a.c. at 50 or 60 cycles. Regulation accuracy is claimed to be ½ of 1 percent.

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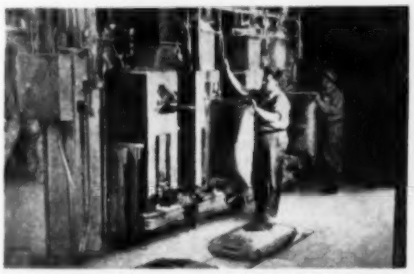
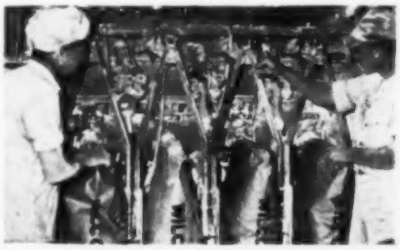
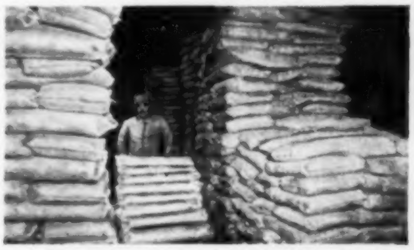


Case History No. 13—Soya Flour: Floor level conveyor handles packer output.



Case History No. 11—Limestone: 4-tube packer permits uninterrupted operation.



Case History No. 14—Chemicals: Multiwalls stack well in storage areas.

Case History No. 12—Soap Powder: One man operates 100-LS packer.

Case History No. 15—Alcohol: Multiwalls save 50% storage space.

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19. COMBINATION of a special mesh screen and a powerful Eriez Alnico permanent magnet in a single compact unit has led to the development of a new magnetic screen trap by Cooney Valve and Screen Co., Box 1358, Erie, Pa. The trap thus combines filtering and magnetic separation action on liquids and gases, removing both magnetic and non-magnetic materials. The magnet is placed outside the trap in such a way as to cause magnetic particles to accumulate on the non-ferrous walls of the trap body, away from the central, removable screen. The screen itself then removes the non-magnetic materials. Easily taken down for cleaning, the screen is removed and the magnet taken off, the latter action allowing the accumulated magnetic material to discharge.

20. A NEW packing introduced by Power Products Co., 11 Broadway, New York 4, N. Y., is known as Style 101 Teflon Plastic packing and is composed of about 93 percent of shredded Teflon, combined with graphite and a suitable bond. The material is then molded into rings that are non-porous yet resilient for ready response to gland pressure. The material is said to be suitable for use in stuffing boxes in contact with such extremely corrosive agents as oleum, nitric acid, phosphorus oxy-chloride and many other materials. Folded or incased Teflon gaskets are available for flanges, handholes and manholes.

21. FOR A variety of difficult process control problems the W. C. Robinette Co., 802 Fair Oaks Ave., South Pasadena, Calif., has introduced the Model 61A Motron Servomechanism. This is a packaged continuous-balance control system employing several miniature vacuum tubes that directly control (without circuit-breaking contactors) the speed and direction of a standard 1/15-hp. motor, according to the setting of an input dial that can be rotated by extremely small forces such as electrical meter movements. Extreme accuracy of response is claimed. Larger power sources are readily controlled in turn by the motor.

22. WITHOUT stopping the pump, stroke adjustments for variation in discharge rate can readily be made with an improved type of micrometer indicating adjustment device that is now available as original equipment on proportioning pumps manufactured by the Milton Roy Co., 1401 East Mermaid Ave., Philadelphia 18, Pa. A vernier dial permits quick and convenient resetting to any predetermined stroke length, to within 1/750th of the full stroke length.

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

51. Industrial Cleaners

MANUFACTURE of two new industrial-cleaning compounds is announced by Kelite Products, Inc., Los Angeles, Calif. Claimed to be the fastest and safest degreaser which this maker has ever produced, Formula 555 has penetrating and softening properties that remove carbon deposits by cold immersion. Especially efficient in cleaning aircraft, automotive and diesel engine parts, fuel pumps, carburetors, filter screens, shock absorbers and brake parts, it is recommended for all metals. Containing no phenolic compounds, the product has a high flash point and is completely safe for the operator. Supplied in two types, Kelite 304 is a fast-working matrix cleaner, intended to be brushed on, allowed to stand for about three hours and then rinsed off. The second type, Kelite 304 E, accomplishes the same job when used in a matrix tank. Providing an economical way to keep tire molds clean without long lay-up times, both types are said to be completely safe on aluminum and steel.

52. Monochloracetic Acid

AFTER being produced several months on a pilot plant scale, monochloracetic acid is now being produced in a large scale operation by the Hooker Electrochemical Co., Niagara Falls, N. Y. This compound is a white crystalline material with a strong sweetish odor. It is corrosive to the skin. Known also as chloracetic acid or chlorethanoic acid, it has the formula $CH_2ClCOOH$. This compound has a molecular weight of 94.5, a melting point of 62 deg. C., a boiling point of 189 deg. C., liquid density at 65 deg. C. of 1.370 g. per cc., heat of fusion of 46 cal. per g., heat of vaporization of 118 cal. per g. Analysis of the high-grade product is as follows: monochloracetic acid—99.8 percent; dichloracetic acid—0.06 percent; acetic acid—none; free chlorine—0.04 percent. Monochloracetic acid consists of monoclinic crystals and is soluble in water, benzene and other organic solvents.

This new product is said to be in considerable demand for agricultural chemicals such as 2,4-dichlorphenoxyacetic acid, a selective weed killer; esters of alphanaphthleneacetic acid used for fruit set and tuber storage control. Other chemicals of commercial importance derived from monochloracetic acid are carboxymethyl cellulose, its sodium salt and other derivatives, thio and thioindigoid dyes, cyanoacetic acid, thioglycollic acid, amonium thioglycollate, and others. Total production of the plant is taken for some time to come.

53. Stabilizer for Vinyls

DEVELOPED by the Advance Solvents and Chemicals Corp., 245 Fifth Ave., New York 16, N. Y. is a stabilizer to prevent the discoloration and chemical breakdown of vinyl chloride and vinyl chloride-acetate copolymers when they are processed at high temperatures and exposed to light. Physical properties of the material which is known as Stabilizer V-1N are as follows: it has a very pale straw color, a ketone-like odor, a specific gravity of 1.03, and has a viscosity (Gardner-Holt) of less than A. It is readily incorporated in vinyl resin when it is worked on a mill or in a Banbury mixer. It is compatible and soluble in vinyl resin solutions and can be used in lacquers and other solutions based on vinyl resins. Its application permits the working of these resins at high temperatures without decomposition of the resin and gives a clear transparent film. Transparency of the film depends on the thickness and concentration of the stabilizer. For films 0.005 in. thick a 2 to 3 percent addition of stabilizer on the resin is suggested.

54. Flame-Proof Compound

ADAPTABLE to most fabrics and fibrous materials, a new flame-proofing compound is now being manufactured by Eronel Industries, 5714 West Pico Blvd., Los Angeles, Calif. Known as Antoxol this compound gives permanent flame-proofing protection to textile materials such as drapes, upholstery, dresses, suits. Antoxol is a

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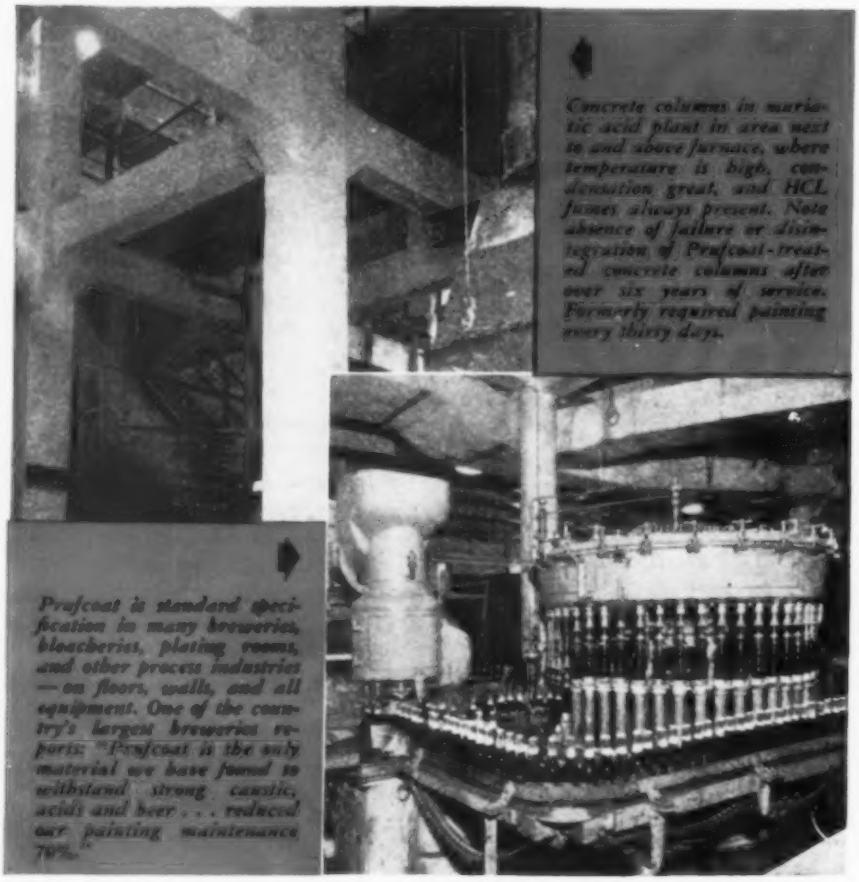
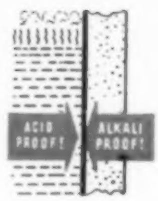
FOR MORE INFORMATION
See Reader Service
Coupon on pages 153-154

Actual tests show Antoxol-treated fabrics to be flame-proof





balsamic resinous organic compound which is claimed not to alter the color, appearance, sheen or feel of delicate fabrics. Tests have shown that this material actually imparts greater tensile strengths to fabrics treated with it. Its effectiveness is permanent because it does not powder off nor dust out, and is resistant to repeated dry cleaning with common dry-cleaning agents. Antoxol is claimed to be nontoxic and non-irritating and is soluble in both water and alcohol.

55. Paint Deodorant

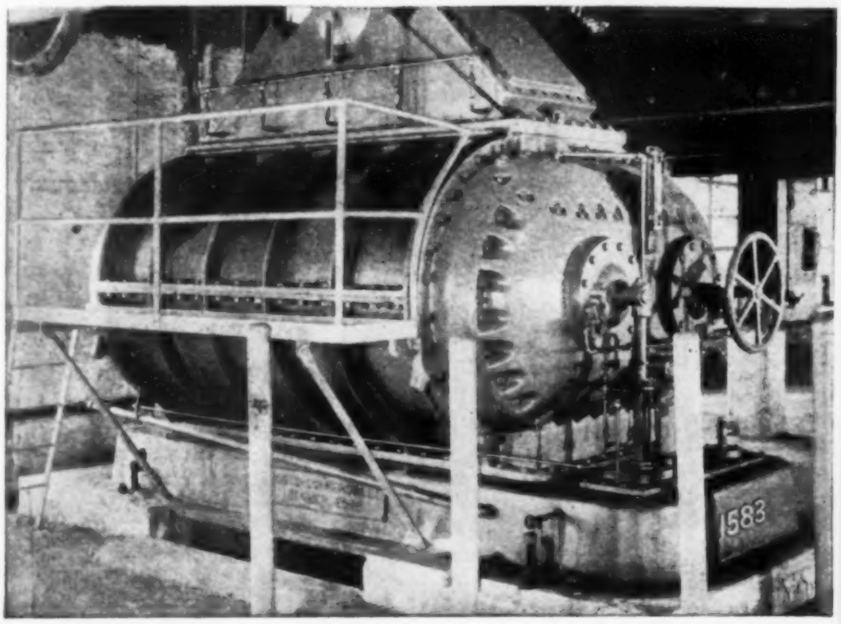
UNPLEASANT odors of fresh paint are claimed to be neutralized by use of a series of new products developed by Givaudan-Delawanna, Inc., 330 West 42nd St., New York 18, N. Y. Under the brand name of Paint-O-Dors, this group of deodorants imparts to paints pleasant fragrances. This includes 10 deodorants and aromatic mixtures for a wide variety of paints. They are easy to use, are inexpensive and are claimed to have no effect on the color, viscosity, drying time or other qualities of the paints. They volatilize completely and leave no odor once the paint is dry. Paint-O-Dors are preferably placed in the vehicle or thinner during the manufacture of the paint, although for experimental purposes they may be added to the finished paint if it is thoroughly mixed to prevent volatilization before the paint is used. Cost ranges from 1 to 4 c. per gal. of paint, but this cost is slightly higher in case of enamels.

56. Anti-Corrosive Finish

RECOMMENDED for industrial use where protection against deterioration of surfaces is important is a new anti-corrosive copolymer finish marketed by the Watson-Standard Co., Pittsburgh 12, Pa. Designated as P-5, this series of coatings is claimed to protect metal, wood, and concrete against corrosion from exposure to moisture, acids, alkalis and other disintegrating materials. It is a fast-drying finish and is free from paint odors, is non-toxic and dries by evaporation without requiring an oxidation period. It has good thermal stability, is resistant to abrasion and scrubbing and has desirable aging characteristics. This new series of finishes is available in several colors and is suggested for use in steel plants, chemical plants, dairies, breweries, etc.

57. Hydrocarbon Plasticizer

A NEW heavy process oil has been developed by the Shell Oil Co., Inc., 50 W. 50th St., New York 20, N. Y. Known as Dutrex No. 7, this material



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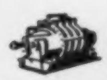

Rotary Positive Blowers are available in capacities from 10 CFM up. Simple design and construction free them from maintenance troubles. Many types and sizes are available for built-in or separate applications.

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is a hydrocarbon plasticizer especially compounded for the rubber industry. It is designed to provide good processing characteristics and good retention of physical properties in rubber processing work. Dutrex 7 is greenish brown in color and has a slight odor. It has a specific gravity of 1.0, a flash point (open cup) of 440 deg. F., viscosity at 100 deg. F. of 956 cs. and a viscosity at 210 deg. F. of 18.8 cs. Extensive laboratory and commercial tests have shown Dutrex 7 to be widely applicable as a softener and processing agent. It is recommended for use on compounds of natural rubber or GR-S for tires, footwear compounds, and in other types of mechanical rubber goods where softness, good processing and resilience are desired.

58. Anhydrous Aluminum Bromide

Now available in sample quantities from the Westvaco Chlorine Products Corp., 405 Lexington Ave., New York 17, N. Y. is an aluminum bromide which is expected to find a number of interesting uses. It is a white solid having high hygroscopic characteristics. Care must be used in exposing it to high concentrations of moisture. It reacts violently with water with the evolution of considerable heat to give off hydrogen bromide. It is readily soluble in most organic solvents and in this respect is superior to aluminum chloride. Most important use appears to be in Friedel-Crafts type reactions. It can be used as an addition compound; for the introduction of the carbonyl group; as a catalyst in hydrocarbon conversion; in the synthesis of methanes, ketones and anthraquinone; and in a number of other similar applications.

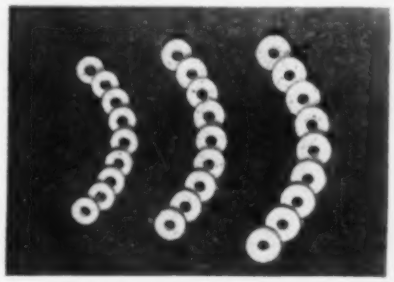
59. Vulcanized Starch

Available in experimental quantities, a "vulcanized" starch, resistant to the swelling action of heat and chemicals, has been announced by National Starch Products, Inc., 270 Madison Ave., New York 16, N. Y. Known as Vulca-100, this new starch product is an inert, non-toxic organic filler. It is not rapidly hydrolized by acids or enzymes and steam sterilization makes no essential changes in its properties. Approximately neutral in water suspension, the starch settles after cooking because the granules are not appreciably swollen or ruptured. This new material is said to have a number of potential industrial applications such as printing thickeners in textile operation, for use in certain creams used in the manufacture of cosmetics, electrolyte carriers in dry-cell batteries, or as ingredients for various food prod-

ucts. Vulca starches are available with various degrees of non-swelling and non-gelatinizing characteristics.

60. Nylon Washers

NYLON washers are now being manufactured by the Atlantic Plastics Inc., 132-31 40th Rd., Flushing, N. Y. Washers are injected molded in six standard sizes. Advantages of nylon fawcet washers are said to be increased



Nylon faucet washers manufactured by Atlantic Plastics, Inc.

resistance to abrasion, resistance to cold flow, freedom from odor and taste, low moisture absorption, good thermal characteristics, low coefficient of friction, and good resistance to chemicals and to changes in temperature.

61. Floor Coating

A DECORATIVE and protective coating for concrete walls and flooring is now available from Carbozite Protective Coatings, Inc., Greensburg, Pa. This new coating is claimed to prevent absorption and attack from mild acid and alkali solutions, oils and detergents, and water. It penetrates the pores of concrete and wood, and will maintain effectiveness even when the floor is well worn. It does not form a thick coating that will chip or mar, and does not create the hazard of slipperiness. Known as Carbo Floor Coat, this material is applied by brushing or by use of a push broom. Two coatings are necessary for effective results. Coverage for the first coat is approximately 200 sq. ft. per gal. and for the second coat approximately 300 sq. ft. per gal. It requires about 3 or 4 hours to dry. It is available in colors of green, red, gray and black, and it is suggested for use in offices, schools, public buildings, homes, factories and other commercial and industrial plants.

62. Organic Solvent

Now available in experimental amounts but scheduled for quantity production in the near future is tetrahydrofurane, according to a recent announcement made by Celanese Chemical Corp., 180 Madison Ave., New

York, N. Y. An effective solvent for vinyl compounds and other materials such as cellulosics, synthetic rubber, alkyd resins and organic chemicals, this material is made from natural gas. Other potential uses are as a chemical intermediate in making adipic and succinic acids, related anhydrides, and other similar chemicals.

63. Styrene Rubber Resin

Recently announced by the Dewey & Almy Chemical Co., Cambridge 40, Mass., is a new high styrene rubber resin for use in compounding natural and synthetic rubbers. Known as Darex Copolymer X-34, this material is a hard, tough resin having low specific gravity, light color, complete compatibility with a range of hydrocarbons, and resistance to aging, chemicals and oils. Darex Copolymer X-34 is a special buna S type rubber resin having an unusually high styrene content. Chemically, it has a higher degree of saturation than ordinary rubbers, but it can be vulcanized alone and it is readily vulcanized in compounds. Because it is less reactive with oxygen and other chemicals, it is claimed to have good resistance to deterioration of physical properties upon ageing and exposure. It is made by emulsion polymerization under closely controlled conditions and is stabilized with 2 percent of an antioxidant. It is coagulated with alum to give fine granules of uniform size. This new material is suggested for use in making rather light colored shoe soles and heels, durable light-colored flooring, and molded mechanical goods. It should be valuable for products requiring abrasion resistance, tear resistance, high hardness, stiffness, and good tensile strength. Since it is somewhat thermoplastic in nature, Darex Copolymer X-34 can be processed readily on an open mill or an internal mixer. It is available as clean, dustless, free-flowing granules in 50 lb. paper bags.

64. Synthetic Wetting Agent

Containing 31 percent active ingredients, a modified alcohol sulphate detergent is now available from the Alrose Chemical Co., Box 1294, Providence 1, R. I. Known as Alrosene 31, this material is a free-flowing, nonsneeze, off-white granular powder with a soap-like odor. It yields smooth paste on dilution with small amounts of water, while a 1 percent aqueous solution is soap-like and milky at room temperature. It is reasonably stable in alkaline, acid or neutral solutions at temperatures less than boiling. A 0.1 percent solution of Alrosene 31 is claimed to produce 3.0 to 3.5 volumes of foam when agitated at 45 deg. C.,

FOR MORE INFORMATION

See Reader Service Coupon on pages 153-154

showing no reduction of foaming in hard water and is unaffected by alkali or acid. It is suggested for use in soaping prints, improving shade brightness, eliminating gumming, and reducing color bleeding in textile operations. As a scouring agent for raw wools, rayons, acetate, and cottons, this material permits operation at low temperatures and causes no lime soap deposits, discoloration, rancidity or interference with further processing. It is suggested for use as a leveling agent and penetrant with acid dyes, vats, developed sulphurs and direct colors.

65. DDT Whitewash

Recently introduced by Tykor Products, Inc., 350 Madison Ave., New York, N. Y., is a new protective coating combining the advantages of DDT and whitewash. Marketed under the name of Insecticidal White, this product is suitable for coating metals, wood, stone, cement and cinder blocks and can be applied with spray or brush. Insecticidal white costs about 30 cents per hundred square feet of surface area and will not chip or flake off. It is available in 50-lb. bags.

66. DDT Emulsion Concentrate

Another DDT insecticide now available is made by the Charles Edwards Chemical Corp., 1011 Diamond St., Philadelphia 22, Pa. This insecticide known as H-4 Emulsion Concentrate is a stable solution which solidifies at 15 deg. F. and which enters into solution as the temperature is increased. It is a homogeneous liquid with an initial boiling point of 284 deg. F. and a steady boiling point of 396 deg. F. When mixed with water it forms an emulsion which may separate slowly over a period of weeks but which becomes a total emulsion again upon agitation. The concentrate consists of DDT dissolved in a mixture of aromatic hydrocarbon solvents.

67. Non-poisonous Disinfectant

Recently announced by Service Industries, 2103 E. Somerset St., Philadelphia 34, Pa., is a dry chemical compound of high germicidal power when dissolved in water. Under the brand name of Steryl, this new disinfectant is claimed to be superior

in germicidal power to many other commonly used disinfectants, and is said to be tasteless and non-toxic to humans or animals. In water solutions, Steryl is a water white, mildly alkaline, non-volatile odorless solution. It is unaffected by freezing, but its potency is claimed to be increased at elevated temperature. It is suggested for use in sterilizing eating and cooking utensils, for use in disinfecting and deodorizing floors, tables, storage bins, containers, etc. It kills most odor-forming bacteria and destroys virulent micro organisms.

68. Aromatic Solvents

IMMEDIATE delivery, in tank cars or drums, of two new solvents is possible according to an announcement by Esso Marketers, 26 Broadway, New York, N. Y. The first of these is a high boiling pure aromatic solvent known as Solvesso No. 150 said to be useful for improving flow-out in lacquers or synthetic enamels and for use in baking enamels. It may also be used for silk screen work, lithographic varnishes, wire enamels and similar applications where combinations of high flash point and slow evaporation rate is required. The second of these products is known as Solvesso No. 100. Typical properties of these two solvents are shown in the accompanying table.

Typical Properties of Esso's New Aromatic Solvents

	Solvesso #100	Solvesso #150
Composition (approx.)		
Aromatics, percent	99.5	95
Aliphatics, percent	0.5	5
Specific gravity at 60 deg. F.	0.875	0.890
Weight, lb. per gal. at 60 deg. F.	7.28	7.41
Color, Saybolt	+ 30	+ 25
Odor	Mild aromatic	Faint, pleasant
Aniline Point (mixed), deg. C.	11.5	20
Kauri-butanol value (toluol = 100)	90	82
Flash, Tag c.c., min. deg. F.	100	150
ASTM Distillation, deg. F.		
I.B.P.	313	372
10 percent	318	376
50 percent	325	380
90 percent	328	385
95 percent	340	387
F.B.P.	344	396

69. Mothicide

AVAILABLE in commercial quantities is a new mothicide available from Fine Organics, Inc., New York, N. Y. Under the brand name of Polychlor, this material is used to relieve, stretch and replace paradichlorobenzene. It is a synergist for either paradichlorobenzene or naphthalene. When used with 50 percent paradichlorobenzene it produces a mothicide said to be equal in strength to pure paradicholorobenzene. 20 percent napthalene added to Polychlor produces a solution claimed to be an excellent mothicide.

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

Limited Funds May Affect Census of Manufactures

THE CENSUS of Manufactures, long awaited by the businessmen of the country, was voted $4 million of the $5 million requested when the department of commerce appropriations bill passed the house last month. Census officials claim, however, that the effect of the house action, if sustained by the Senate, would be much more drastic than the 20 percent cut indicates.

Reason is that census has always depended on the technical staff that produces its large group of monthly, quarterly and annual Facts for Industry reports to lay the groundwork for the infrequent Census of Manufactures.

Census was relying on the $2.278 million it asked for its Facts for Industry series to carry part of the preliminary work for the Census of Manufactures. The House, while slicing 20 percent off the amount specifically earmarked for the census cut the request for the current industrial statistics program by 62 percent. Thus instead of getting an increased amount for its current series, Census was cut back to half of what it had for fiscal 1947. Consequently, unless funds are restored by the Senate which seems doubtful as of the end of last month, it appeared that both the Facts for Industry series and the Census of Manufactures would suffer. Part of the additional funds requested was earmarked for 63 new commodity surveys.

M. C. A. Celebrates Its Diamond Jubilee

CHARLES S. MUNSON, re-elected president of the Manufacturing Chemists' Association, led several hundred of the industry's top executives in an enthusiastic birthday celebration that featured the Association's 75th annual meeting at Skytop, Penna., June 4. His address entitled "Then and Now" traced the almost unbelievable progress of the American chemical industry from its early beginnings to its present stature as a multi-billion dollar enterprise.

Two speakers at the annual dinner: H. W. Fisher, president of Enjay, Inc. of New York and George L. Parkhurst, president of the Oronite Chemical Co. of San Francisco. Both dealt with developments in the petrochemical industries. Fisher noted that $100 million is now committed for new plants on the Gulf Coast to supply petroleum raw materials for chemical manufacture. This will inevitably cause some dislocation of markets but should lead ultimately to a more stable basis for synthetic organic chemicals.

Mr. Parkhurst chose to discuss the future of aromatic chemicals formerly derived exclusively from coal-tar. As much as 85 billion pounds of these compounds could be made annually by the petroleum industry if demand warranted.

Burns Named Secretary of Electrochemical Society

ON July 1 the Electrochemical Society will make certain changes in its headquarters, organization and office. At that time Dr. R. M. Burns, director of chemical research for the Bell Telephone Laboratories and a former president of the society, will become secretary succeeding Dr. Colin G. Fink, resigned. Dr. Fink will turn over the duties of secretary after having served for 25 years. He becomes secretary emeritus.

Dr. Burns' address will continue to be at the Laboratories, 463 West St., New York, N. Y.

The new address of the headquarters office will be 235 West 102nd St., New York, N. Y. The office will be under the supervision of the assistant secretary who will be announced shortly. All routine correspondence should be sent to this address on and after July 1.

ASTM Holds Annual Meeting At Atlantic City in June

IN addition to the 20 formal technical sessions which are part of the tecnnical program for the fiftieth (1947) Annual Meeting of the American Society for Testing Materials in Atlantic City, June 16-20 inclusive, there will be more than 250 meetings of the society's technical committees. All sessions will be held at Chalfonte-Haddon Hall. There will be morning, afternoon and evening events on each of the days except the last day, Friday, June 20, when the closing sessions are scheduled for the afternoon.

Commercial Solvents Plans Nitroparaffin Plant

CONSTRUCTION of a $20 million plant for the manufacture of nitroparaffins on the Gulf Coast inside of three years is contemplated by Commercial Solvents Corp., according to Dr. Henry B. Hass, consultant to the company. In making the announcement last month at Galveston before Southeastern Texas Section of the

Reconstruction is under way at Monsanto Chemical Co.'s Texas City styrene plant. Quonset huts have been erected as temporary buildings and heavy debris is being removed.

American Chemical Society, Dr. Hass said the plant will produce about 100,000 lb. of nitroparaffins daily. Location of the plant was not disclosed.

AIChE Holds Regional Meeting in St. Louis

SIX HUNDRED chemical engineers and guests attended the St. Louis regional meeting of the American Institute of Chemical Engineers May 11-14. A full program of technical sessions and plant visits culminated in a colorful banquet addressed by Institute president Charles M. A. Stine who talked on "The Engineer in a Free Economy." The two are interdependent, he averred, for "one cannot live without the other." This country owes much to the engineer for his contribution to improved living standards but the engineer, in turn, owes much to the democratic methods of our government.

"The engineer," he said, "could not survive under a state controlled economy. The whole setup operates to crush him, to make his efforts negative, to rob him of his independence

CONVENTION CALENDAR

American Association for Advancement of Science, chemical research conferences, Colby Junior College, New London, N. H., June 16-Aug. 22.

American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-20.

American Society for Engineering Education, annual meeting, Minneapolis, Minn., Nicollet Hotel, June 18-21.

Chemical Society, centenary of foundation, London, July 15-17.

Instrument Society of America, second annual instrument conference and exhibit, Stevens Hotel, Chicago, Ill., September 8-12.

Porcelain Enamel Institute, annual forum, Ohio State University, Columbus, September 10-12.

American Chemical Society, 112th national meeting, New York, September 15-19.

American Institute of Chemical Engineers, regional meeting, Hotel Statler, Buffalo, N. Y., September 29-October 1.

Electrochemical Society, fall congress, Copley-Plaza Hotel, Boston, Mass., October 15-18.

Pacific chemical exposition, Civic Auditorium, San Francisco, Calif., October 21-25.

Exposition of Chemical Industries, 21st exposition, Grand Central Palace, New York, N. Y., December 1-6.

of action, to cramp and channelize his thinking, to subject him to political controls and pressures."

A Sunday afternoon feature designed to interest students and junior members dealt with three phases of the work of the chemical engineer. D. F. Chamberlain of Washington University presided and talks were given by Charles L. Schmidt, process superintendent of National Lead, Donald H. Tilson, works manager of Aluminum Ore Co., and Fred Olsen, director of research of Western Cartridge Co.

Plant trips included inspections of the new Nuclear Physics Laboratories at Washington University, the breweries of Anheuser Busch, the organic and heavy chemicals plants of Monsanto Chemical Co., the zinc operations of American Zinc Co., alumina production by Aluminum Ore Co., rubber reclaiming by Midwest Rubber and petroleum refining by Shell Oil Co.

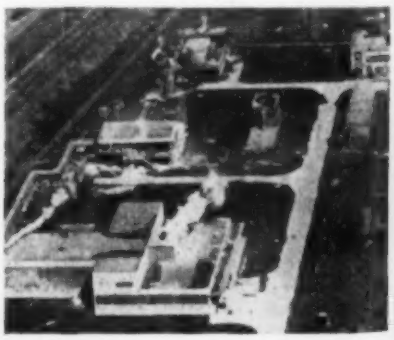
Roy G. Heminghaus of Monsanto was general chairman, and Jules Bebie, honorary chairman. Francis C. Curtis presided as toastmaster at the banquet.

Carbide Begins Texas City Ethylenediamine Output

The first ethylenediamine produced at the Texas City, Tex., plant of Carbide and Carbon Chemicals Corp. was shipped last month by air to Charles Lennig and Co. at Philadelphia. The 22 drums containing a consignment of over 10,000 lb., will be utilized in the manufacture of dithane potato fungicide. Production of the chemical began at Texas City on May 12.

At the Galveston municipal airport, from which the shipment was made, Harley M. Ross, superintendent of Carbide's plant, said that the company's expansion plans have not been

This Aerial view shows Pathfinder Chemical Corp. at Niagara Falls, N. Y., newest subsidiary of The Goodyear Tire & Rubber Co. Recently completed, the Pathfinder plant produces vinyl resins for use by Goodyear's chemical products division at Akron



Members of the Manufacturing Chemists' Association, visit model industrial effluent plant of the Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.

affected by the Texas City disaster and will continue over the next few years.

Company officials pointed out that in addition to its use in manufacturing potato fungicide, ethylenediamine is being utilized in a process whereby asphalt may be laid on wet surfaces, and in the preparation of dyes, waxes, insecticides and certain medicines.

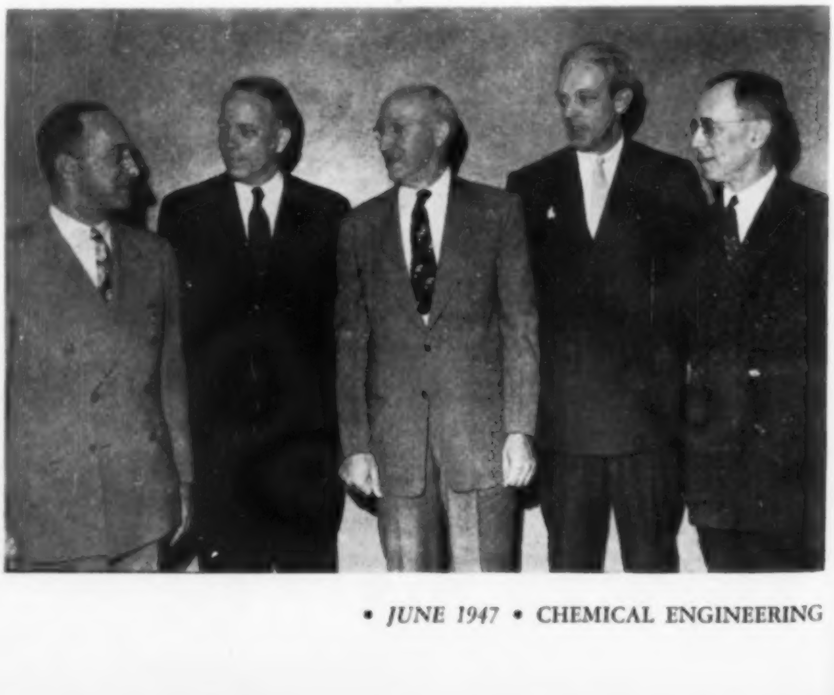
Export Trade to be Subject Of DCAT Meeting

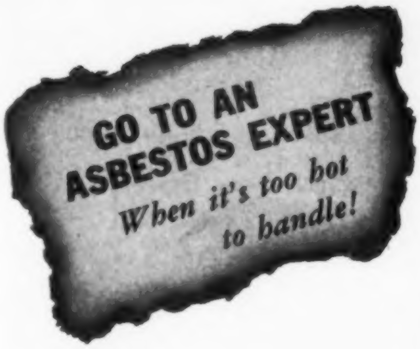
Future of American Drug and Chemical Exports will be discussed at the spring luncheon meeting of the Drug, Chemical and Allied Trades Section of the New York Board of Trade on June 25 at the Hotel Pennsylvania. The speaker will be Earl I. McClintock, president of Winthrop Products, Inc., and vice president of Sterling Drug Inc.

Construction Begins on New Sulphuric Acid Plant

Construction has begun on a new plant for the manufacture of contact sulphuric acid by International Minerals & Chemical Corp. as an addition to its fertilizer and acidulating plant at Lockland, Ohio. The contract for the new plant has been let to the H. K. Ferguson Co. of Cleveland, and construction is expected to be completed

At the annual technical meeting of the Standard Oil Co. (Indiana) and the affiliated companies, at French Lick, Indiana, held May 5-9, problems of research work for the past year were reviewed. Eighty-one papers on motor fuels, engineering and process design, process development, chemicals and technical service were presented. Shown below discussing the meeting are P. H. Sullivan, manager development and patent department; R. C. Gunness, associate director of research; R. H. Price, director of research, Pan American Petroleum & Transportation Co.; M. T. Carpenter, executive director, Whiting Laboratories; and G. W. Watts, head of the engineering department





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in time for operations to begin by the first of next year. The new building will be a compact, modern unit measuring approximately 100 by 170 feet with an annual capacity of 45,000 tons.

SPI Elects New Officers At Chicago Convention

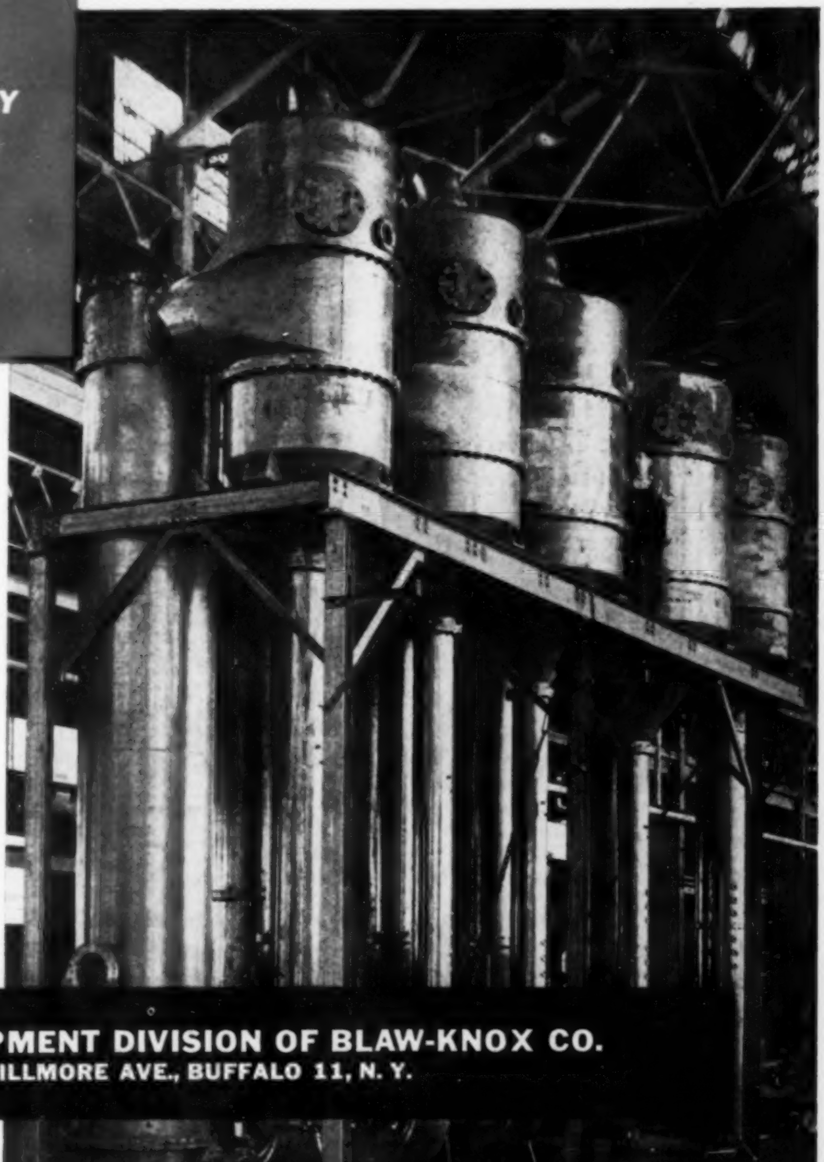
Leaders of the plastics industry finished the annual conference and election of the Society of the Plastics Industry in a mood of confidence, alerted to the problems of a competitive market. They heard both praise and warnings in the opening session, a Merchandising Forum where Kurt Emde of Zenith Radio Corp., Chicago, and Harry A. Barth of W. T. Grant Co., New York, were guest speakers, with Charles A. Breskin, editor of *Modern Plastics*, presiding. Thirty-eight papers were presented on technical and economic aspects of the industry.

George H. Clark was named the new president of the SPI in the annual elections held at the Stevens Hotel. Mr. Clark, vice president of Formica Insulation Co., will hold office for the fiscal year June 1947 to June 1948. Retiring president Neil O. Broderson of the Rochester Button Co., Rochester, N. Y., succeeds George K. Scribner of Boonton Molding Co., Boonton, N. J., as chairman of the board. George Brown, one of the society's founders, was elected vice president. He is vice president of Bakelite Corp., New York. The new secretary is Norman Anderson, president of General Molded Products, Inc., of Des Plaines, Ill. Warren E. Hill, vice president, Prolon plastics division, Pro-phy-lac-tic Brush Co., Florence, Mass., was named treasurer.

George H. Clark

American Cyanamid Plans To Expand Subsidiaries

The American Cyanamid Co. has announced a plan for financing which involves changes in the capital structure of the company. The plan con-



templates securing additional capital to be used with other funds for carrying out a program of expanding facilities for producing existing and new products in the fields of pharmaceuticals, dyestuffs, pigments, plastics, and other chemicals for additional investments in Jefferson Chemical Co., Inc. (jointly owned with the Texas Co.) and Southern Alkali Corp. (jointly owned with Pittsburgh Plate Glass Co.) to be used in their plant construction programs and for working capital incidental to additional sales volume. The plan also contemplates redemption of the entire amount of 5 percent cumulative preference stock of the company now outstanding in the amount of $14,817,740.

Andrew Fletcher
Elected president of St. Joseph Lead Co. at annual meeting in May

Chemical Corps Advisory Committee Created

SEVENTEEN leading American chemists and chemical engineers have been named by Dr. Roger Adams, chairman of the board of directors of the ACS, to a Chemical Corps advisory committee created at the request of Major General Alden H. Waitt, chief of the corps. Dr. W. Albert Noyes, Jr. ACS president, and head of the chemistry department in the University of Rochester, is chairman of the committee, which will serve as a liaison group between the Corps and the chemical profession and industry, and will provide advice on scientific and personnel matters in connection with Chemical Corps research and development.

Other members of the committee are: Dr. Adams, head of chemistry department, University of Illinois; Prof. Arthur C. Cope, head of chemistry department, Massachusetts Institute of Technology; Col. Bradley Dewey, Cambridge, Mass.; Dr. Willard H. Dow, president and chairman of Dow Chemical Co., Midland, Mich.; Prof. Vincent du Vigneaud, head of the chemistry department, Cornell Univer-

sity Medical College; Prof. Louis F. Fieser, Harvard University; Dr. P. K. Frolich, coordinator of research, Merck & Co., Rahway, N. J.; Prof. H. F. Johnstone, the University of Illinois; and Sidney D. Kirkpatrick of New York, chairman of the American Section, Society of Chemical Industry.

Also, Dr. Walter Kirner, director of the Chemical and Biological Coordination Center, National Academy of Sciences, Washington, D. C.; Dr. Stanford Moore, Rockefeller Institute for Medical Research; R. L. Murray, vice-president and technical director, Hooker Electrochemical Co., Niagara Falls, N. Y.; Prof. Charles C. Price, head of the department of chemistry, Notre Dame University; Prof. Glenn T. Seaborg, University of California; Prof. Harold C. Weber of Massachusetts Institute of Technology; and Dr. Robert E. Wilson, chairman of the board of directors, Standard Oil Co. of Indiana.

AGA Convention Moved To Cleveland

American Gas Association found it impractical to effect arrangements in San Francisco for its 1947 annual convention and exhibition. Plans have therefore been changed, for a convention to be held in Cleveland, Ohio, on October 6 to 8, inclusive. No equipment exposition will be held.

Gulf Chemical Building Texas Phosphate Plant

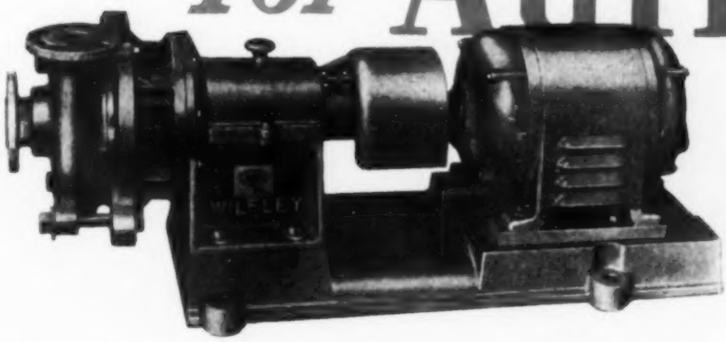
Plans have been completed and foundation work started for the Gulf Chemical Co.'s $1 million plant at Galena Park, near Houston, Tex., which will manufacture phosphate products. The project, expected to be completed in January 1948 is on a 27-acre tract adjoining the Houston ship channel. Design of the plant was in charge of Truman B. Wayne and Associates of Houston. The Gulf Chemical Co. was organized last year.

Tung Oil Association Meets in Pensacola

E. C. Gay, of Gulfport, Miss., was re-elected president of the American Tung Oil Association at the concluding session of the annual convention held last month at Pensacola, Fla. Marshall Ballard, Jr., Lumberton, Miss., was elected secretary-treasurer.

Over 150 growers and millers heard a report by a Department of Commerce expert, Edmund C. Wood, to the effect that China was making slow progress in getting its tremendous tung oil industry under way after the war. Mr. Wood said that imports of

for ACIDS



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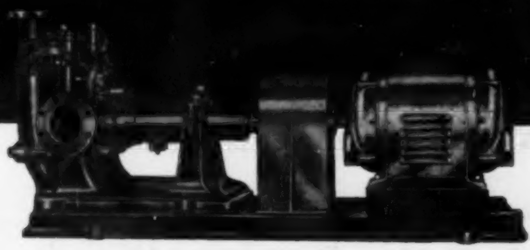

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tung oil into the United States from China during 1946 amounted to only 10,000 tons but added that 1947 receipts should be greater.

Nut oil production in 1946 in the six-state American tung belt along the Gulf Coast was 47,300 tons, a gain of 28 percent over 1945. Mississippi led with 20,000 tons followed by Louisiana with 14,000 tons.

Ammonium Nitrate Handling Rules Recommended

Fourteen precautions that should be observed in handling and transporting ammonium nitrate are outlined in a joint report on the Texas City disaster released by the Fire Prevention Bureau of Texas and the National Board of Fire Underwriters. The report points out that the War Department Ordnance Safety Manual classifies ammonium nitrate as an explosive when it is stored with other combustibles in an explosive area. Smokeless powder regulations apply to ammonium nitrate.

The fourteen recommendations of the two fire prevention organizations are:

1. Material should be stored only in masonry or fireproof sprinklered buildings.
2. Storage should preferably be in separate fire divisions from highly combustible commodities or well segregated.
3. Piles of ammonium nitrate in paper bags in storage should not exceed 10 bags high, six bags wide and 30 bags long with 3 foot separation between piles and handling aisles of 10 feet every 100 feet.
4. Spilled material from broken bags must be re-sacked immediately.
5. Ship's holds or boxcars must be thoroughly clean before loading operations are begun.
6. Spilled material in the hold, cars or on dock and discarded sacks must be removed immediately.
7. Proper dunnage and sweat-boards must be used in ship's hold and box cars to prevent friction and to allow for circulating of air.
8. Smoking or the use of open lights *must be strictly prohibited* at any time.
9. Other cargo must not be placed in the same hold with ammonium nitrate.
10. Keep material clear of all steam lines and wiring.
11. Pending the outcome of tests now in progress, it is suggested that steam *not* be used for fire fighting in compartments containing ammonium nitrate.
12. Any ship with ammonium ni-

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trate entering a port must notify the port facility who in turn should notify the chief of the fire department immediately.

13. Fire departments combatting ammonium nitrate fires should use only water in large quantities (applied gently so as not to scatter the material) as an extinguishing agent and all personnel entering the fire area must wear masks approved for use in such locations. Fire in ammonium nitrate usually generates large quantities of oxides-of-nitrogen gases which are extremely toxic.

14. Cities in which large industrial operations are present or which are in areas subject to hurricanes, earthquakes, tornadoes and other like disturbances should have a well preconceived and organized disaster plan to include all relief, law enforcement, fire fighting, military and naval agencies.

Sinclair Expands Chemical Production at Houston

A MODERNIZATION and expansion program which may reach a total investment of about $35 million is under way at Houston, Tex., refinery of Sinclair Refining Co. Manufacture of insecticides, which has not been previously undertaken at the plant, will be included in the program.

Other features of the project include a new barrel house, embracing grease making, compounding, and production of specialty oils; a new 30,000 bbl. per day crude distillation unit to replace an existing old unit; two new wax sweaters; and expansion in capacity of the lubricating plant. A new can plant was completed several months ago.

Montrose Plant Begins DDT Production

Now reaching capacity operations is the Torrance, Calif., DDT plant of Montrose Chemical Co. of Calif., a subsidiary of Stauffer Chemical Co. and the Montrose Chemical Co. of Newark, N. J. Starting production on May 12, this firm becomes the first commercial producer of this important insecticide material in the western states. Output of the new plant, which represents a total investment of approximately $500,000, is expected to reach 5,000,000-7,000,000 lb. annually, according to company sources. Such an output would represent over 10 percent of the present total production of DDT in the United States.

Raw materials for the Montrose plant consist of monochlorbenzene and chloral, both now produced on a large scale by the firm at Henderson, Nev. Chloral is normally produced by


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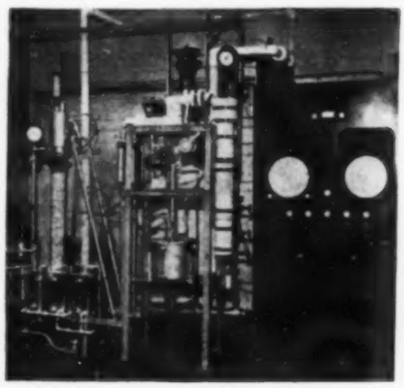
the chlorination of alcohol in the presence of a catalyst to form chloral alcoholate, from which chloral is liberated by acidulation with dilute sulphuric acid.

DDT is formed by the reaction of chloral and chlorbenzene in the presence of strong sulphuric acid, followed by neutralization and separation operations. Byproducts of the Montrose chloral and monochlorbenzene operations at Henderson consist of ortho and para dichlorbenzenes.

Industrial Use of Activated Carbon Studied at Mellon

A NEW research group has been established at Mellon Institute, Pittsburgh, to study industrial applications of vapor-adsorbent activated carbon. This group is part of a fellowship sponsored by Carbide and Carbon Chemicals Corp. It will cooperate with users of vapor adsorbent carbons to improve equipment and processes for recovery of solvent vapors, to study methods for the purification of industrial gases and deodorization of air, and to study industrial processes for separation of materials in the vapor phase.



Section of pilot plant equipment

To aid these studies, a pilot plant for solvent recovery with activated carbon has been installed. Automatically controlled, this plant replaces a manually-operated unit, and can duplicate accurately the conditions in industrial solvent recovery plants using activated carbon.

New Texas Hydrocarbon Plant Under Construction

CONSTRUCTION of the first unit of McCarthy Chemical Co.'s plant at Winnie, Tex., for the manufacture of unsaturated and aromatic hydrocarbons from natural gas began this month. Completion of the $3 million project is scheduled for early in April, 1948. Construction of a second unit, representing an estimated investment of $4 million, will begin soon and

should be finished next year in July. The two units will process a total of 150 million cubic feet per day of natural gas produced from McCarthy reserves in the Winnie-Stowell-Jackson Pasture area on the Gulf Coast.

Officials of the company, which was organized last year, are: Glenn H. McCarthy, president; G. M. McGranahan, vice president and general manager; Frank Champion, vice president and treasurer; and A. G. McNeese, secretary.

New York Junior Chemical Engineers Elect Officers

OFFICERS for 1947-48 were elected at the May meeting of the Junior Chemical Engineers of New York following a talk on ion exchange by A. B. Mindler, Permutit Co. The new officers are: president, E. C. Fetter, *Chemical Engineering*; vice president, Fritz Von Bergen, Westvaco Chlorine Products Co.; secretary-treasurer, Monroe M. Solomka, National Lead Co.; and assistant secretary-treasurer, G. S. Merritt, Foster Wheeler Co.

Monsanto Chemical Opens New Plastic Plant

MONSANTO Chemical Co. has announced the opening of a new plant at Springfield, Mass., for the manufacture of the company's textile-treating chemical known as Resloom. This textile chemical, a new type of melamine resin, imparts shrinkage control, mass resistance and stability to woolens, rayons, cottons and blends. The Springfield plant will have a yearly output capable of processing 50 million yards of fabric.

West Coast Resin Plant Starts Operations

ONE OF the first postwar factories built exclusively for the production of surface finishing resins is the Anaheim, Calif., plant of General Electric Co., which began operations on May 21. The unit, which is claimed to be the most modern and streamlined of the General Electric Co. resins plants, is producing glyptal alkyd resins. Raw materials consist of phthalic anhydride, glycerine and an oil, either linseed, soybean or castor.

With a capacity of 4,050,000 gal. from six kettles, the Anaheim works will be the largest producer of alkyd resins on the Pacific Coast. The plant occupies a six-acre site. In addition to the tank farm and storage building, there is a main process building with a floor area of 19,000 sq. ft. of which 3,000 sq. ft. will be occupied by offices and laboratory. Besides the six reaction

kettles, equipment includes seven thinning tanks, ten 8,500-gal. storage tanks for finished products, two steam boilers and one Dowtherm boiler.

General Aniline Holds Research Conference

All divisions of General Aniline & Film Corp. were represented by the 140 men and women, who gathered to attend the semi-annual research and development conference of the corporation at Skytop, Pa., on May 5. Members of the technical staff, the group convened for a reception and banquet, with technical sessions on May 6-7. Scientific papers delivered to the group covered a variety of technical subjects relating to dyestuffs, photographic materials and other company products.

Alamo Refining Purchases Surplus Texas Plant

Purchase of the Abercrombie-Harrison 100-octane aviation gasoline plant at Sweeny, Tex., by the Alamo Refining Co. of Houston has been announced by Alamo officials. Purchased from War Assets Corp. for $13.1 million, the plant originally cost about $28 million. Phillips Petroleum Co. is principal stockholder in the new Alamo organization.

The facilities consist of a two-stage fluid catalytic cracking unit, hydrofluoric acid alkylation, catalytic isomerization of butane, thermal reforming and crude distillation. The plant has been idle since October, 1945.

Stauffer Plans New Process Unit at Niagara Falls

The Stauffer Chemical Co. has announced the forthcoming construction of a new process unit at their Niagara Falls plant. It will be used for the chlorination of organic chemicals. This addition is being constructed for and will be operated by the NYO Chemical Co., which is jointly owned by Stauffer and the Harshaw Chemical Co. A contract for the design and erection of equipment has been let to the Scientific Design Co., Inc., New York.

Heyden Memphis Plant Starts Chlorbenzene Output

Monochlorbenzene and allied products are now in production at the new Memphis plant of the Heyden Chemical Corp. The present limited production is spoken for, officials said, but added that monochlorbenzene, mixed higher chlorinated benzenes and muriatic acid will all be available shortly for general sale. This will be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in addition to the chlorine, liquid caustic soda and hydrogen with which the plant began operations late last year, although much of the chlorine output is being utilized at the plant for the production of the chlorinated benzol products.

READERS' VIEWS and COMMENTS

Snarled Nitrogen

To the Editor:

Sir:—I was much interested in your "Watching Washington" item "Nitrogen Badly Snarled" (April 1947, p. 82).

For many decades we have been depleting our soil of nitrogen, and only replacing a portion of the loss. In round figures, we are taking annually from our soil 5,000,000 tons of nitrogen more than we are restoring. This is equivalent to drawing checks on a bank and depositing only half as much as checked out. The heaviest deficits in our nitrogen "bank" are found in the tobacco and cotton growing states.

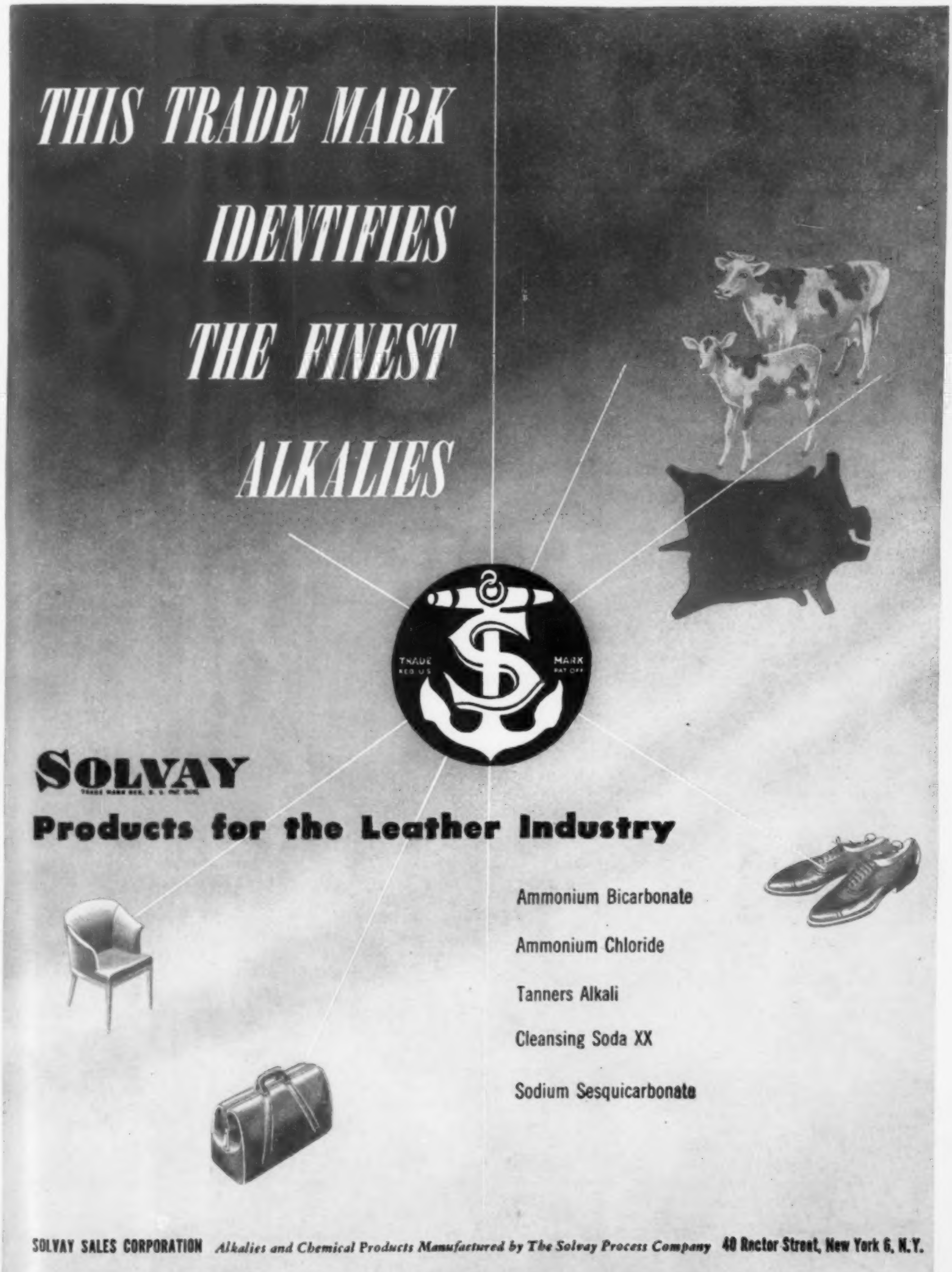
The writer spent some time in Norway in 1905 when the first fixation of atmospheric nitrogen on commercial basis was effected by the Birkland-Eyde process. Later he was consultant on the German cyanamide developments, and still later consultant on the Japanese cyanamide projects with the attendant hydroelectric plants. One of the most interesting hydroelectric plants used for chemical operations is the Fusenko project in northern Korea, now in Russian possession. To get a 2,180 ft. hydraulic head, the Japanese drove a tunnel through a mountain range, the tunnel being 12 ft. 4 in. x 13 ft. 4 in. in section and 17 miles long. Part of this 250,000 kw. of power is being used by the Russians for nuclear fission developments.

Even if a real nitrogen program was evolved sufficient to equal the depletion now going on, it would take a very long time to get a "credit balance" in our soils. The destruction of German plants which could have been readily utilized to produce nitrogen, and thus help to level off the unbalanced situation of the whole world, is nothing more than pure dumbness.

It is to be hoped that this country will wake up and take steps to "unsnarl" the nitrogen situation.

James E. Cassidy

Consulting Engineer
Washington, D. C.



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NEWS FROM ABROAD

Special Correspondence

MANY NEW CHEMICAL PRODUCTS EXHIBITED AT FIRST POSTWAR BRITISH INDUSTRIES FAIR

First postwar British Industries Fair, held early in May after an interval of eight years, saw a prominent and promising display of many new chemicals, but few manufacturers were able to accept orders for early delivery, and the foreign visitors were unwilling to put up with indefinite delivery promises. The visitor went away with a feeling of high expectation of new things to come, but the would-be buyer was disappointed. As a show of technical progress and new products likely to reach the commercial stage in the next few years, however, the B.I.F. was very interesting. Some firms confined themselves to showing models of new plant under design or construction, others displayed samples of new products introduced during the war, some of them as substitutes for formerly imported commodities, or to be made in the future.

The wide range of finished products, pharmaceuticals, dyestuffs and specialties, on show at the B.I.F. bears out the view that as overseas markets develop their own heavy chemical industries British exports will tend to shift from simple bulk materials to more specialized and complicated fine chemicals and finished preparations the production of which depends on a high degree of research in development and skill in manufacture while the quantities required are too small to permit economical production in small markets. Another point to be noted at this year's B.I.F. was the attention given to petroleum chemicals. Of this more will be heard when the projected enlargement of the British oil refining industry has been effected and more raw materials are thus available for hydrocarbon chemicals.

Meanwhile the coal position has improved. Not only have chemical manufacturers in various parts of the country received larger allocations, but the change over to the five-day working week in the coal mines has taken place with a minimum of disturbance and without any appreciable loss of output. Other shortages unfortunately tend to come to the fore as the fuel position shows some slight improvement. Steel and containers threaten to become serious bottlenecks, and the labor supply is only just sufficient to meet the industry's requirements. The expectation of further price advances naturally adds to the pressure of demand, but the latest official survey reveals again the seriousness of the chemical supply situation.

According to the Board of Trade, "it is likely to be well into 1948 before the gap between production and requirements is appreciably narrowed; accentuating difficulties in the short term are low stock levels and comparatively poor import prospects." Cases of factories being held up by the impossibility of securing chemicals indispensable for their line of manufacture have been reported, and authorities have tried to overcome this by buying key chemicals abroad, but these attempts seldom have proved successful.

Priority for Chemicals

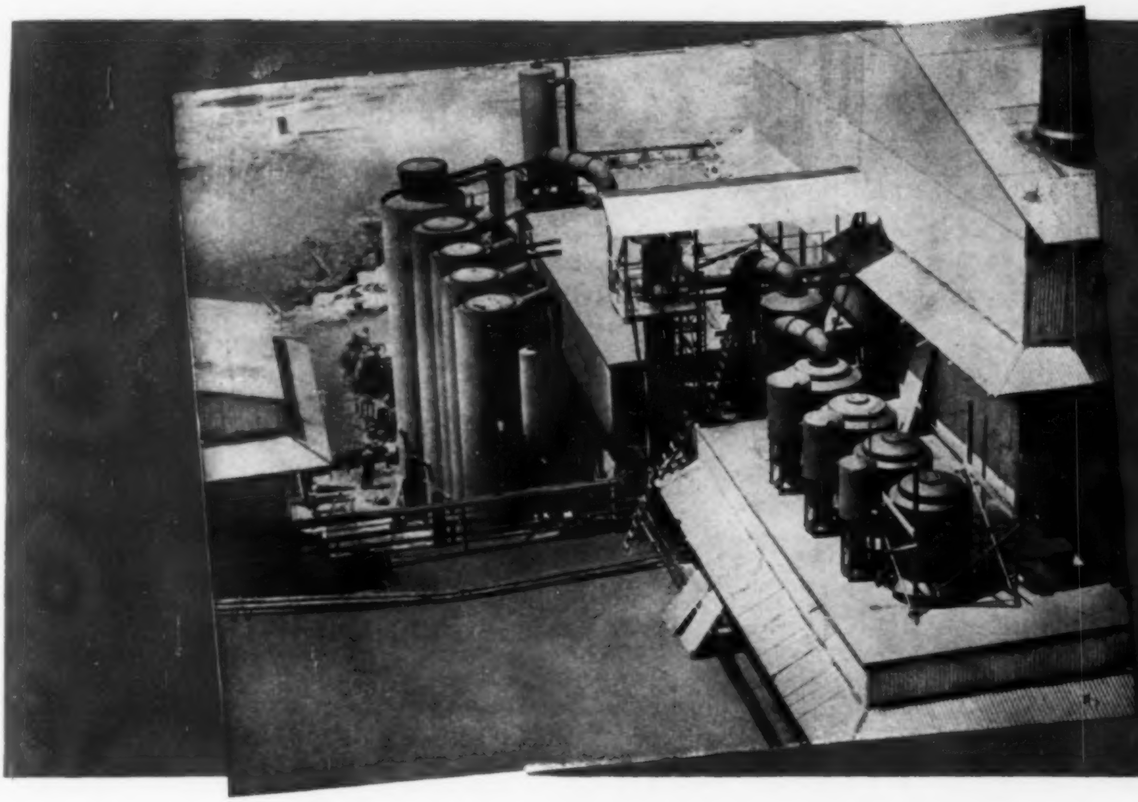
As it is realized that the effect of the coal shortage was more serious in the chemical industry than probably anywhere else, authorities are giving chemical firms priority in fuel-saving installations. Opportunities for such economies, however, must not be overrated. Not unnaturally the subject has received considerable attention of late. Thus Lord McGowan, chairman of Imperial Chemical Industries, states his company's oil-burning capacity will rise to 30,000 tons by September and 150,000 tons by March next year. The resulting saving of 240,000 tons of coal may be compared with a saving of the order of 200,000 tons per annum effected by use of new methods of fuel economy in the last five years. Oil-burning installations are thus shown to be a useful help towards saving coal, but the cumulative effect of this and other coal economies will do hardly more than offset the increase in the chemical industry's coal requirements resulting from normal output expansion.

Despite current production difficulties, the chemical industry is planning substantial increases over the next few years. Imperial Chemical Industries reports in its annual statement that the first stage of development in the big organic chemicals scheme at Wilton is to be completed in four years; work has started on roads, drains and foundations, and 1947 should see the work well advanced on that portion intended for the first stage of industrial operations. A new nylon polymer plant, having a considerably increased capacity as compared with the Huddersfield plant which supplied the material during the war, is now in course of erection at Billingham; this will meet demands of the nylon yarn factory at Pontypool (scheduled capacity: 10,000,000 lb. p.a.) and the increased requirements of I.C.I. plastics plant.

Substantial capital expenditure also is being incurred for the manufacture of "Gammexane" and "Methoxone." I.C.I. further intend to erect plant for the manufacture of fluorinated hydrocarbons as non-toxic refrigerants, and extension of capacity is "actively in hand" to meet the increased demand for many other products "including alkali, dyestuffs, non-ferrous metals, paints, plastics, sulphuric acid, Nitro-Chalk and urea." A start has been made on a research laboratory for fundamental research in temporary premises at Welwyn. Steps have been taken to increase production of synthetic detergents.

Imperial Chemical Industries, like other chemical manufacturers, has experienced difficulty in bringing new technical developments to the commercial stage, and this also applies to extension schemes for wartime products whose peacetime value could not be evaluated before. Demand for some of these, like "Perspex" and polythene is so heavy that the substantial capacities provided during the war proved insufficient to meet requirements.

"Terylene," the new synthetic fiber discovered by the Calico Printers' Association, is now under evaluation and development, and research on the evaluation of new polymers may, in the words of Lord McGowan, well result in the discovery of other fibers.



French Company to Make Chemicals in Canada

SITE for a Canadian plant to cost between $400,000 and $500,000 is being sought by the Pyrenees Fuel and Solvent Co., according to Georges A. Maury, of Paris, director of the company. He stated French and Canadian capital will be combined in the undertaking which will make chemicals from sawdust, grain and other waste products.

After the initial plant is in operation and demonstrations prove a success, other plants may be established. Owing to the great lumber industries in Quebec and British Columbia particularly, the advantages of locating the pilot or test plant in either of those provinces is recognized.

Mr. Maury who came to Canada last March already has looked over the possibilities for establishing the plant in Quebec. Now he is surveying the B.C. field. In France, he said, it would take probably two and a half years to construct the plant, owing to scarcity of materials, while it was estimated that the period could be reduced to ten months in Canada owing to the abundance of essential supplies.

Soviet Plants Speed Up Fertilizer Outputs

TOTAL of 2,160,000 tons of nitrogenous fertilizers, potassium chloride and superphosphates are to be produced by Soviet chemical plants in 1947, which is 85 percent more than actually produced in 1946. In 1948 the output of fertilizers is to reach 3,130,000 tons, exceeding the prewar output by 20 percent.

By the end of 1946 all nitrogenous-fertilizer plants damaged during the war were partially restored, and capacities are steadily increasing. In 1946 the output of nitrogenous fertilizers achieved 95 percent of prewar production. This year production is to be increased to 108 percent, and in 1948 to 130 percent of the 1940 output. In addition to restoration of damaged nitrogenous-fertilizer plants, the Five-Year Plan provides for construction of three new plants: Lisichansk (Donbas), Kemerovo (Siberia), and Kirovakan (Soviet Armenia), as well as extension of capacities of the Chirchik chemical plant in Uzbekistan.

Production of superphosphates was completely suspended during the war, but between 1944 and 1946 some sections of a number of plants were restored and put into operation. A new plant was built in Kokand, Central Asia, which in 1946 was operating at half capacity, and is to reach total capacity this year. Three more plants

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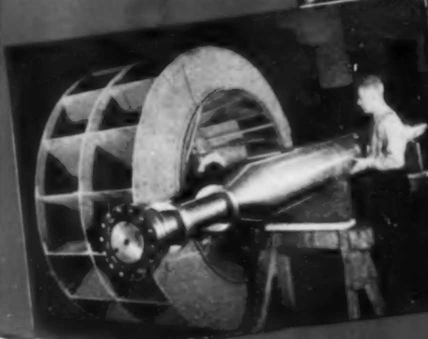

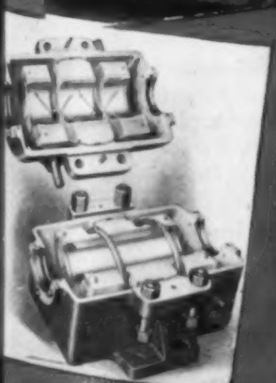

Left. Bearings are self-aligning and water cooled . . . adequate in every respect for smooth running with minimum friction.

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are to be built in Central Asia before the end of 1950.

To supply the Central-Asiatic superphosphate plants with ore, construction was started in 1944 of the "Kara-Tau" mining-chemical combined plant, first section of which was put in operation in 1946. On the whole, however, development of superphosphate production is not satisfactory, and the plan for the putting new capacities in operation was fulfilled in 1946 by less than 50 percent. The plan for 1947 calls for production of almost twice the amount for agricultural needs produced in 1946.

Bulk of potassium fertilizers is supplied by the Solikamsk Potassium Combine in the Urals, where deposits amount to 18,400 million tons of potassium oxide. Besides, potassium salts with a smaller content of the basic substance are produced by the Kaluga and Stebniki potassium combines. In 1946, equipment of the mines and the chemical plant of the Solikamsk Potassium Combine underwent capital repairs, allowing them to catch up with the prewar output. In 1947 output is to be increased by 80 percent, compared with 1946.

Uranium Minerals Sought In Australia

Plans have been made secretly by the Federal Government of Australia in cooperation with the States for exploration of uranium and other radioactive minerals suitable for development of atomic energy in Australia. No official statement on these plans has yet been made by the Commonwealth, although an announcement has been made of the decision to request the Council for Scientific and Industrial Research to begin work on the development of atomic energy as a source of industrial power.

Australia's only known deposits of uranium are at Mt. Painter and Radium Hill, South Australia. Intensive investigations during the latter part of the war failed to locate lodes beyond those generally known to exist. The net content of the more extensive Mt. Painter deposits is estimated at only two tons of uranium trioxide.

Argentina Limits Imports Of Crude Sulphur

In an effort to built up a domestic industry, Argentina requires consumers of sulphur to use a certain proportion of domestically produced material to round out their requirements. This not only cuts down import requirements but there also is a control over inward shipments. The Department of Industry and Commerce has re-

cently announced that up to 45,000 metric tons of sulphur may be brought into the country during the current year.

Uruguay Regulates Trade In Caustic and Soda Ash

Soda ash and caustic soda have been declared prime necessities in Uruguay and made subject to trade controls which obligate holders of such stocks and importers to declare the amount of their holdings and submit a record of their previous sales. The Industries Office also is authorized to establish sales quotas. It was further provided that chemicals which the Customs Office considered as substitutes for soda ash or caustic soda might be declared prime necessities and made free of import duties.

Larger Output of Chilean Nitrate This Year

It is expected that production of sodium nitrate in Chile will reach 1,700,000 tons in the fiscal year ending June 30, 1947. For the preceding fiscal year the output was 1,603,820 tons. Nitrate shipments in the latter part of 1946 were curtailed because of a work stoppage at the Tocopilla docks and a large part of production went into stockpiles but the shipping situation has been normal since the first of this year. A number of marginal plants are closed but 12 plants were in operation at the beginning of the year.

German Soap Production Below Requirements

Because of the acute shortage of fats and oils, soapmakers in Germany are not able to produce enough soap to meet anything like normal requirements. There is not much hope for immediate change in this situation and the shortage is expected to last until imports have been restored to normal. In the meantime, intensive efforts are made to collect used fats and to expand production of synthetic detergents.

Soviet Scientists Develop Chrome-Plating Process

A new method of chrome-plating, said to eliminate the possibility of dry friction, thus increasing the durability of any machine parts subjected to friction, has been reportedly devised by Soviet experts.

The new method called "porous chrome plating" is described as follows: The working surface of the cylinder is covered with a chrome coat

from 0.15 to 0.20 millimeters thick, by means of the electrolytic method. Then the direction of the current in the electrolytic bath is changed, and the cylinder treated is converted into an anode. This results in the chrome coat beginning to dissolve in the electrolyte, and this dissolution proceeds so that the surface of the chrome coat becomes speckled with a multitude of holes (pores) or with a network of tiny ducts. As soon as the pores or the ducts reach necessary dimensions, the process is stopped.

While allowing the cylinders to retain all the positive qualities of a chrome-plated surface, this simple operation fully eliminates the possibility of the appearance of dry friction. The tiny ducts and pores become tiny lubricators, retaining the lubricant and ensuring continuous lubrication of the working surface of the cylinder. As a result, durability of the cylinder increases up to 20 times.

Czechoslovakia Increases Production of Glass

Production of glass of all types in Czechoslovakia was greatly speeded up in the latter part of last year. Plate glass production in 1946 amounted to 107,600,000 sq. ft. or 58 percent of the prewar volume. Production of hollow glassware was 70,000 tons and small glassware 5,000 tons. This was 61 and 45 percent respectively of the 1937 output of these products.

Foreign News Briefs

Nitrogen fertilizer is again being produced at the Linz Steel Works, Austria. The plant went into postwar production in July 1946 but was forced to close early in 1947 because of lack of coal.

Five margarine producers in Denmark have established a joint distribution and sales company under the name of A/S Margarine Compagniet M.C. Headquarters are in Copenhagen.

Phosphate rock shipped from French North Africa was made subject to an export tax for the duration of the war. A permanent export tax of eight francs a metric ton has now been made effective.

Diamond Research Department of Industrial Distributors Ltd., has taken over the Industrial Diamond Information Bureau established in 1943 at 32 Holborn Viaduct, London. The Bureau invites inquiries from users on problems encountered in the industrial use of diamonds.

Diaphragm Control Valves

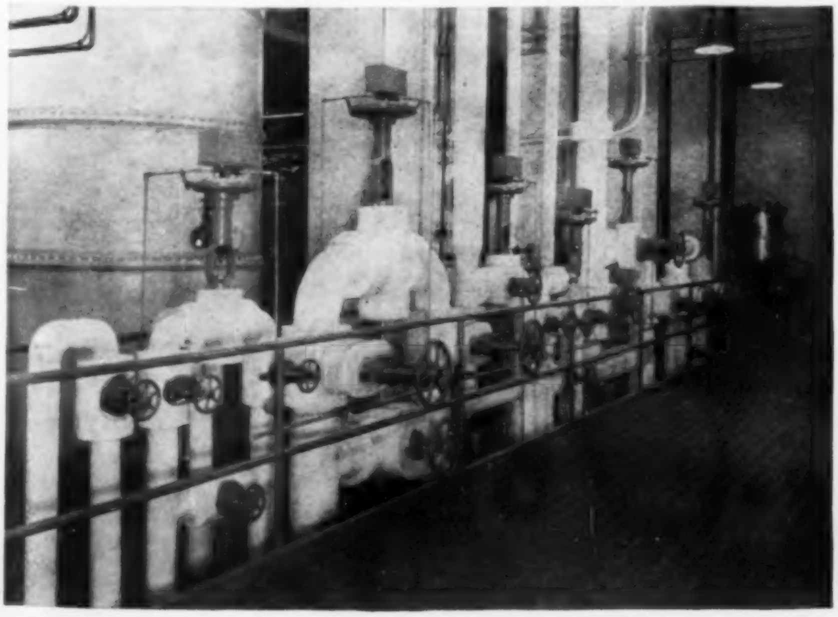
CONSTRUCTION MATERIALS AND DESIGNS FOR CORROSIVE AND HIGH-TEMPERATURE SERVICE IN THE CHEMICAL INDUSTRIES

ARTHUR J. KOCH

Ewart, Healy and Koch, Inc., Boston, Mass.*

MODERN industrial processes, with modern instrumentation, have made the automatic control instrument and its attendant air operated diaphragm control valve a familiar sight in many plants. Not many years ago, the oil industry was the only large user of automatic controls, and it was through the increasingly severe demands and thorough field testing in this industry that control equipment has reached its present state of high efficiency. More recently, the chemical industry has become increasingly aware of the benefits of automatic control, and the question of materials of construction as it applies to control valves has assumed greater importance than ever before, even in the oil industry. Anyone who has been concerned with the manufacture of control valves during the last ten years, or longer, has certainly noticed the increasing frequency of customer specifications requiring valves of special materials. This article is intended to be a general discussion of the question of materials of control valve construction, and also, a brief review of some design features as they apply to special or corrosive service applications.

Diaphragm valves in distillery control flow of 50-150 psi. steam to mash stills. Iron bodies, bronze trim, actuated by temperature controllers



How Valve Works

For the benefit of those who have not been too closely connected with control equipment, we have shown a cross section of a typical diaphragm control valve. Its function is to respond to the air pressure transmitted by a control instrument (or manual air loading device) so that an increase or decrease in flow through the valve occurs in exact relation to the air loading pressure. This control of flow is accomplished by means of variable positioning of the valve plug, which has been made to a calculated shape to give a definite flow curve. The flow curve is a plot of quantity against valve plug travel. The plug is positioned by means of the air load acting on a diaphragm which bears against a diaphragm plate opposed by spring pressure. Thus, the plug travel is directly proportional to the air loading received from the control instrument. This is a simple system, or so it seems on the surface. But there are complicating factors, such as friction and diaphragm area variation, and it is frequently necessary to use an auxiliary device to secure very precise and positive positioning of the valve plug. However, this aspect is of secondary concern to us at the moment. Referring to our illustration, the principal parts of the valve are identified, and those that are of interest to us from the materials standpoint are the valve body, the blind flange, the bonnet and stuffing box parts, the valve plug, stem, seat rings, and plug guides, or bushings. We have no intention of disregarding the materials of which the superstructure is made in respect to corrosive service. However, the requirements here are usually not so severe and, in turn, the choice of ma-

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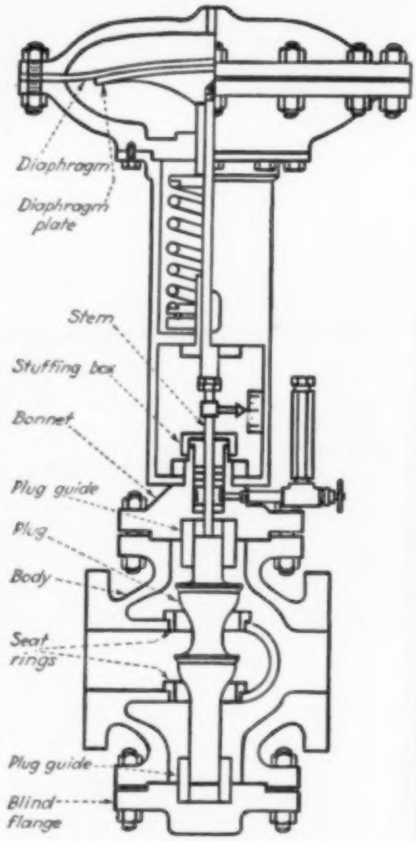
terials offered by manufacturers is not so varied as with the parts enumerated before.

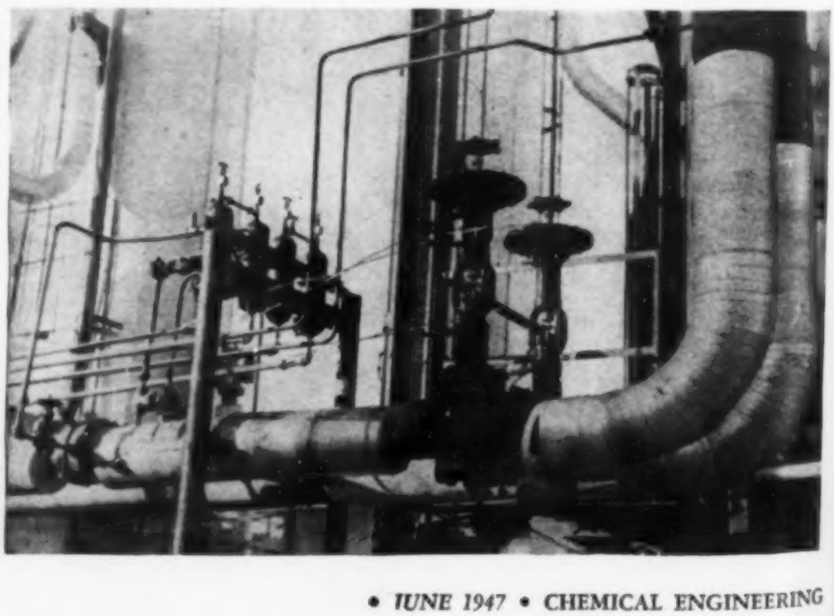
By far the largest number of control valves are supplied with cast body construction. The conventional materials are bronze, cast iron, or steel. Blind flanges and bonnets are frequently of the screwed on type in smaller size valves. In larger sizes the bolted on type is general. In this connection, some manufacturers supply steel blind flanges and bonnets on their iron valves as standard construction. This fact must be checked if the service requires the valve to be of cast iron as far as the body, blind flange and bonnet are concerned. Most valves are also supplied with a pressure lubricator on the stuffing box and, in the case of steel valves, with an isolating valve on the lubricator to insure safety when refilling the lubricator with the valve under pressure. Valve plugs, stems, and seat rings are usually supplied of 18-8 chrome-nickel stainless steel even in bronze valves, as the superiority of this material over bronze or other material for "valve trim" makes the slightly higher cost negligible. Steel valves and iron valves of some makes are suplied with guide bushings for the valve plug in the bonnet and the blind head. These are usually made of a material harder than that of which the plug is made, frequently Type 440 hardened steel. This allows closer clearances than if the same material as the plug material were used. The bushings are frequently pressed in and tack welded, and can be replaced. Seat rings are usually removable, held in place by threads, although sometimes they are supplied silver soldered. Retention of seat rings is a difficult problem in valves of large size, and even with small sizes difficulties arise, such as cutting out of the threads at the seat-



Cross section of typical diaphragm control valve showing principal parts

Cover Picture: Diaphragm valves actuated by flow controller to control flow of gas at 800 psi. to absorber in natural gasoline plant. Valves are cast steel with stainless steel trim, V-port, double seated. (Valve photos courtesy Fisher Governor Co.)

Diaphragm valves in hydrocarbon line, with stainless steel trim, 1,500-lb. cast steel bodies, air fins, power positioners and handwheel units for manual operation or valve travel limiting



rings on superheated steam service. Valve stems are usually screwed directly into the plug and pinned. However, some designs provide for a "tee head" at this point which allows some freedom in lining up the stem and plug. So far as the writer knows, no manufacturer has seen fit to offer a superfinished valve stem, a detail which would do much to increase stuffing box and stem efficiency. This is a brief review of the type of construction which has been, and continues to be, suitable for most services, namely, the handling of water, steam, inert gases, and a great many liquids.

For High and Low Temperatures

While the specifications just discussed might be said to represent a basic pattern, various changes in construction and materials are required if the valves are to be suitable for extremes of temperature, pressure, or for use with corrosive liquids or gases.

The body materials mentioned have, of course, temperature limitations. Bronze bodies are frequently rated up to 350 deg. F., iron bodies up to 450 deg. F., and carbon steel bodies to 750 deg. F. For service temperatures over 750 deg. F., depending upon the pressure encountered, 2½ to 3 percent chromium, ½ percent molybdenum steel is frequently specified due to its increased retention of rated strength at high temperatures. The usual stainless steel trim is satisfactory at elevated temperatures. Hardened trim is used for service where erosion is a factor. If the flowing temperature is around 500 deg. F. or over, it is very desirable to furnish a bonnet with fins for air cooling in order to keep the stuffing box and lubricant temperature down, thus increasing packing life and lubricant efficiency.

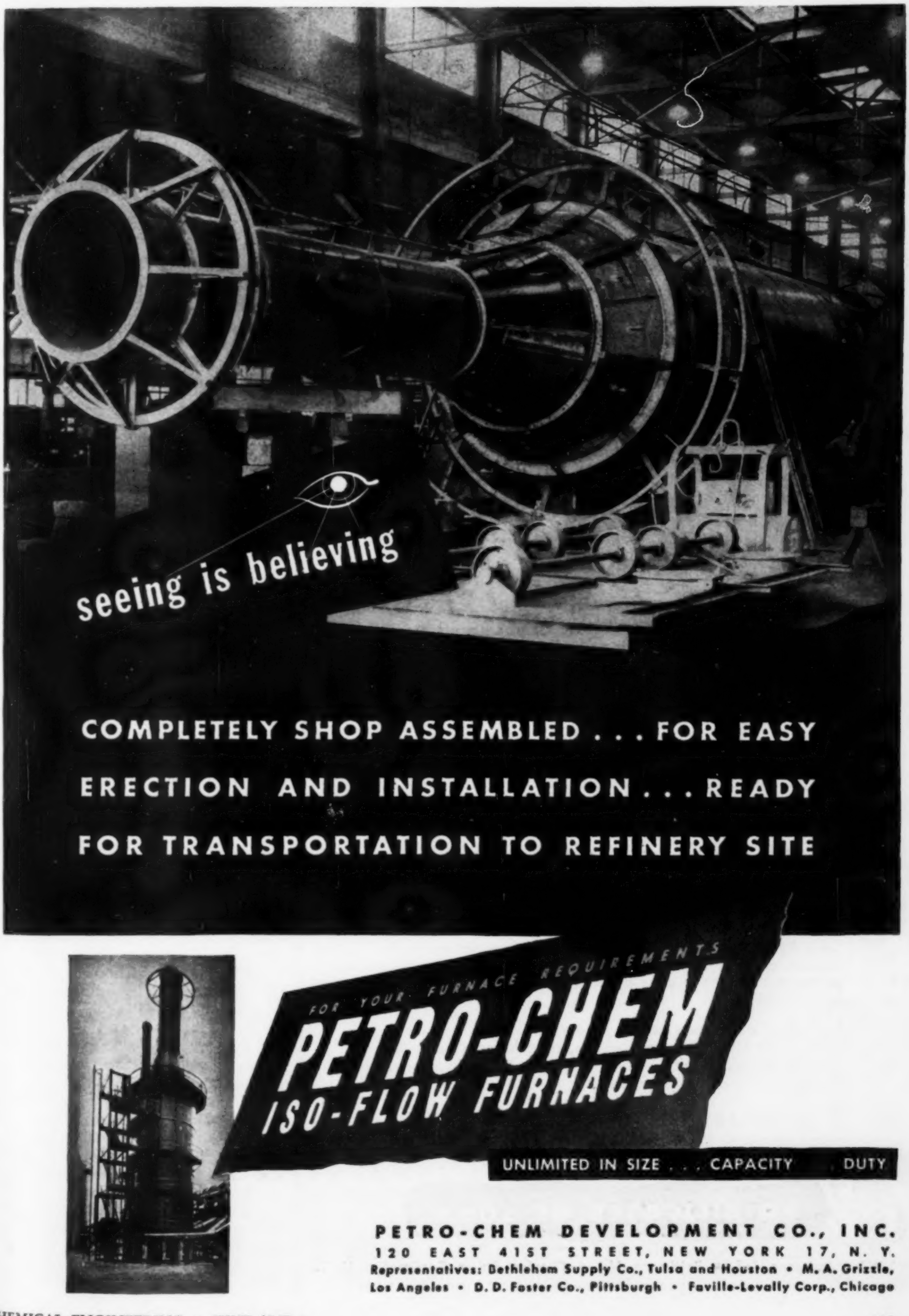
On the other hand, extreme low temperature brings a similar, and yet different problem in respect to the valve body and stuffing box. In this case, the property of most metals of becoming more brittle at low temperatures is a dominating factor. Cast iron has been used at temperatures around −50 deg. F., bronze or aluminum-killed steel at −100 deg. F. Below this temperature, 2½ to 3 percent nickel steels are usually recommended. Type 304 or similar stainless steel trim has been found very satisfactory on such applications, provided of course that erosion is not expected. As for the stuffing box, it must now be warmed rather than cooled, for the reason that formation of ice on the valve stem with consequent cutting of the packing is serious. Again, air fins on the bonnet are useful, either exposed to the atmosphere or steam traced for heat

supply. Sometimes an extension neck is supplied, either with or without air fins, for the same purpose. When valves are purchased for low temperatures, some buyers specify a Charpy impact test to be made on a specimen from the melt from which the body is cast. Needless to say, the bonnet and blind flange should be of the same material as the body, although this need not be true of the air fins, which are sometimes made in the built-up weldment type, rather than in the integrally cast type.

Another aspect of the temperature problem concerns the flow of high melting point materials. Jacketed valves have been built whereby steam or a heating medium such as Dowtherm can be circulated around the valve body to liquefy the material (in conjunction with heated lines) so that the process may be started up. Some of these valves have been rather elaborate, involving ported castings and special connections. Usually all that is required is that the valve be wrapped with a layer or two of tubing to act as a heating coil, or with strip heaters where electricity is used, and then properly covered with insulating material. Sometimes, with bronze valves, wrapping the body with copper tubing for steam heating and sweating the tubing to the body with solder works very well. Another simple means utilizes a special blind head which has a built in chamber, thus heating the valve from the bottom.

Special Seals

From the foregoing it is evident that the stuffing box requires special attention and is a potential source of friction and leakage. Where poisonous materials or a very valuable product, whose loss in even small amounts is serious, are being controlled, some manufacturers are offering a bonnet with a bellows seal. This is now available from one manufacturer in all valve sizes, although in the larger sizes it has been necessary to restrict the valve travel to accommodate a bellows of reasonable length. These bonnets are suitable for quite high temperatures and pressures. The only materials in which bellows for this purpose are available at present are Type 347 and Type 304 stainless steel and bronze; Monel bellows have not as yet been produced in suitable form for this use. This design is of tremendous value and is gaining wide acceptance. For example, valves with bellows seal bonnets have been used to control Dowtherm, both liquid and vapor. When handling a high melting point material it is essential that the material be fluid in the valve, particularly in



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the bellows seal, before the valve stem is moved or the bellows will be ruined. Such a valve lends itself readily to heating of the bellows, since the bellows is usually enclosed within a tube which may be drilled and tapped for steam heating connections. It is well to install these valves with the bellows above and vertical so that any material in the bellows will drain when the system is emptied. Obviously, the limiting factor on corrosive service is the material of which the bellows is made, namely, Type 347 or Type 304 stainless steel.

In addition to the bonnet types previously cited, two other designs which have a limited use may be mentioned. These are the so-called flushing type and the sealing type bonnet. The flushing type is exactly what the name implies; a connection is provided below the packing gland for the introduction of a flushing liquid, the prime purpose of which is to keep the valve stem and plug guide free of matter which otherwise might be deposited from the flowing fluid. This obviously aids in obtaining smooth valve action and sometimes is essential to keeping the valve in service at all. The sealing type has another stuffing box below the standard stuffing box with a connection to the intermediate space into which is piped a supply of an inert gas such as nitrogen. This acts as a restrainst against leakage of what is usually an explosive or poisonous gas. Occasionally, a sealing gas may not be used, in which case a vent line is connected instead, which permits any leakage of gas to be vented outside the building or plant area. Hydrogen fluoride catalytic plants use special bonnets of this type.

Adaptations for Gases

The handling of gases, both inert and corrosive, in control valves offers some interesting points. Oxygen requires no special materials of construction, but care must be taken to see that the valve is free of grease or oil. Therefore, no conventional lubricant should be used in the stem lubricator. Silicone lubricant is excellent for this service. Hydrogen offers a peculiar problem in that it is extremely difficult to retain at any appreciable pressures. It will leak through iron castings. Hence, except for low pressures in the order of a few pounds per square inch, cast steel should be used and all joints should be very carefully made up. Sometimes iron valves are lacquered on the inside as a means of sealing against hydrogen leakage due to porosity. Of course, the packing should be kept in good, lubricated condition. Chlorine and hydrogen chlo-

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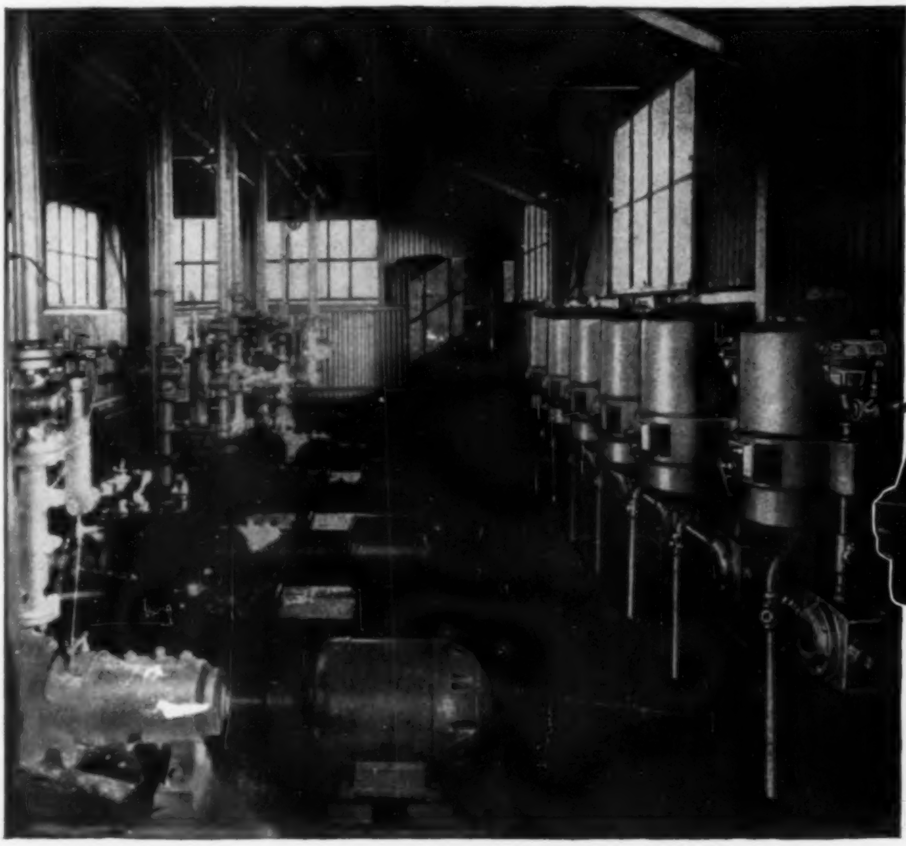

An installation of Crouse-Hinds explosion-proof CONDULETS showing the use of Type EZS Offset Sealing Condulets between Type OFC Push Button Station Condulets and Type EPC Motor Starter Condulets.

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ride can be handled with iron or steel valves with 18-8 stainless trim, but only if they are dry. If the chlorine is apt to be wet, cast iron bodies with Hastelloy-B trim have been used. Hydrogen fluoride is exceptionally toxic and requires a special bonnet as noted in the preceding paragraph. Steel bodies are usually used. Due to an unfavorable condition that occurs with stainless trim, and also to the solvent action on silicon, a low silicon Monel is usually used for valve trim. Certain types of special packing have been found useful. Gases such as sulphur dioxide, ammonia, freon, carbon dioxide, or hydrocarbon gases such as propane, offer no special problems except as their temperature dictates. Propane, for example, is customarily handled in valves with nickel steel (2½ to 3 percent Ni) bodies, stainless steel trim, with extension neck or air fin stuffing box if the temperature is low, or with conventional steel valves at higher temperatures. As with any corrosion problem, the resistant material should be selected on a practical basis. For instance, in the case of hydrogen sulphide, cast iron valves with stainless trim will give reasonable service. There are several other alloys which are inert to hydrogen sulphide, such as aluminum and Type 304 stainless steel. Inasmuch as diaphragm control valves are readily available in the latter alloy, this would be the practical choice.

In the Case of Acids

Control valves for handling various acids have been built of a multitude of materials. Here the problems are complex, depending largely on the concentration and temperature. Again, all factors should be weighed and a practical selection made. The alloys which are most readily to be had in control valve bodies are ordinary bronze, cast iron, cast steel, Type 304 and Type 316 stainless steel, and the silicon and aluminum bronzes. If a selection can be made from this list a great advantage in cost and delivery will result. Similarly, bronze, stainless steel (Type 304 or Type 316), and Monel trim are most readily to be had from control valve manufacturers.

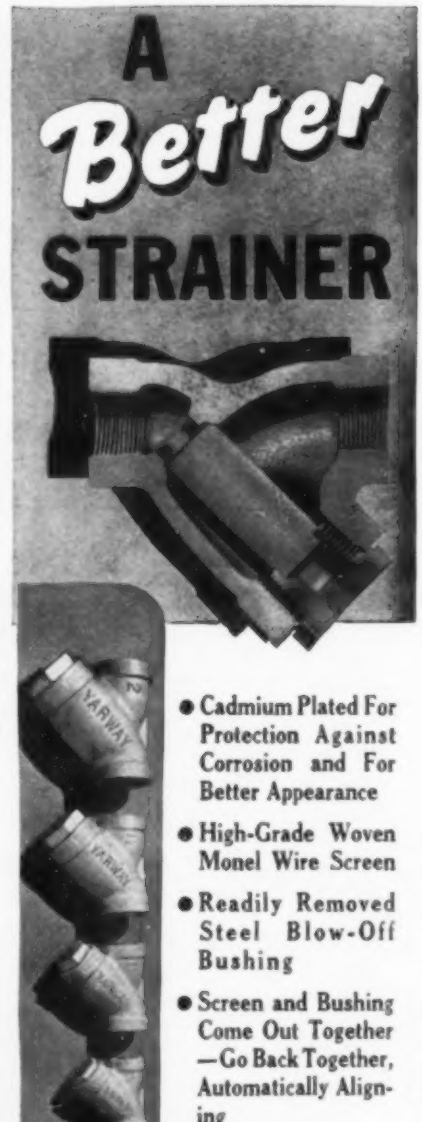
The most commonly handled acids are acetic, hydrochloric, nitric, sulphuric and sulphurous. Acetic acid at ordinary temperatures and all concentrations is frequently handled with Type 316 stainless bodies and trim. Monel has been used at higher temperatures with good results. Hydrochloric acid at low temperatures and concentrations can be handled with cast iron or steel bodies having Monel trim. At higher temperatures and concentrations very excellent results are

obtained with valve body and trim of Hastelloy-B or C. In the case of nitric acid, throughout its range of temperature and concentrations, control valves with all parts in contact with the acid of Type 304 stainless steel are recommended. Sulphuric acid has been handled in its various states by control valves of many alloys. Our notes show about a dozen. Cold, concentrated (98 percent) acid is a good application for cast iron body and stainless steel trim. At low concentrations, aluminum and silicon bronzes are widely used. For higher concentrations and temperatures, all parts in contact with the liquid could be Hastelloy-B with good results. Durimet-T is highly recommended for the hot dilute acid and most cold concentrations, but is not very widely used in control valves, at least as far as our experience shows. Sulphurous acid, frequently handled in paper mill work, has been controlled with valves having bodies of Misco-C (29 Cr, 9 Ni) with Type 316 stainless steel trim and with valves of all Type 316.

Too Bad About Superstructures

While most of our discussion has concerned the valve body subassembly, we would like to point out that control valves are often placed in locations where the atmosphere is intensely corrosive, and superstructure deterioration may be more troublesome than corrosion in the valve itself. So far, this condition has not been satisfactorily solved. Superstructures are available in cast iron and in steel in a variety of finishes. However, spring stem guides, springs, and other parts do not last long in many locations. One of the worst locations in this respect is in the Southwest near the Gulf. Enclosure of the superstructure is of some assistance, but some better solution must be found to protect these vital parts. Frequent inspection seems to be the only answer so far.

Before closing we must recommend a few sources of practical information which should be in the hands of anyone interested in control valves. These are: (1) "Powell Valves for Corrosion Resistance," a catalog which lists on pages 17 and 18 a most extensive compilation of data on fluids and suitable valve materials. (2) *Chemical Engineering's* "Materials of Construction Report," exceptionally useful in the enormous lists of available alloys it presents together with their analyses and corrosion resisting properties. (3) "Properties of Some Metals and Alloys," prepared by the International Nickel Co. (4) "Combating Corrosion in Process Piping," T.P. No. 408, Crane Co., 103 pages, 1939, $3.



FROM THE LOG OF EXPERIENCE

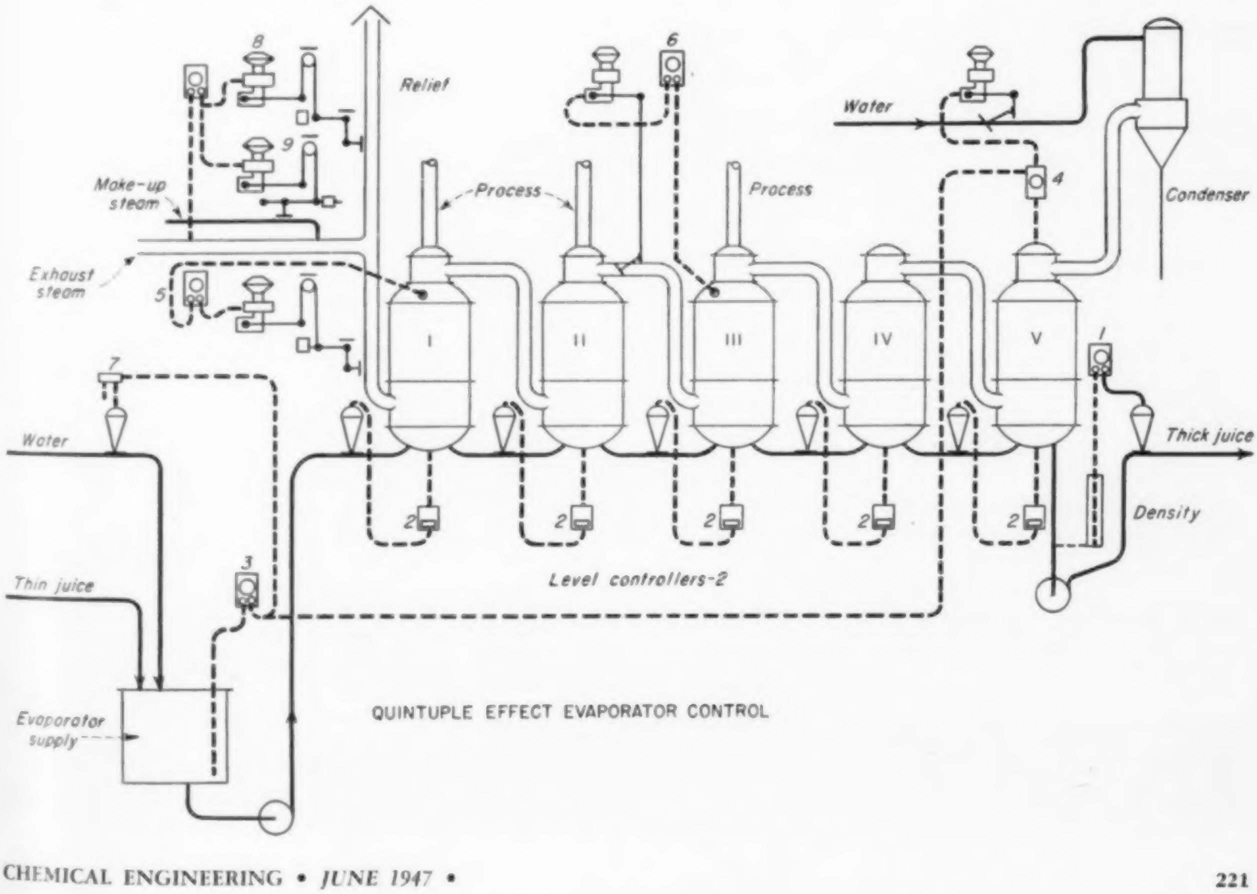
Dan Gutleben, ENGINEER

THE PEREGRINATING operator of the evaporators twenty-five years ago distressed President Carlton of Holly Sugar Corporation no end. There was so little to do but, like holding on to the bicycle handle bars, it was important. Now comes Taylor Instrument Co.'s J. G. ("Zieg") Ziegler, a monkey-wrench physicist, with a simple automaton that accomplishes mechanically what the Old Man wanted the timekeeper to do by accounting. Every time Carlton visited one of his factories the superintendent had to hide the evaporator operator to avoid presidential notice of the "loafer." Why didn't Zieg do this simple thing twenty-five years ago and thus relieve an embarrassing situation? The answer is that he learned how only last year.

AUTOMATIC CONTROL of the quintuple effect sugar house evaporator starts with an impulse of the density of the liquor in the 5th body, at (1) in the sketch. When the density reaches the figure on the dial, say 65 deg. Brix, an impulse is relayed to an air motor and presto the discharge valve opens. Then all of the liquor level controls, (2), on each body, back to the supply valve on the first, successively act to maintain the level that has been prescribed by the setting of the dials. If the rate of flow of the thin juice from the process were constant, the quantities and temperatures of the vapors in the respective bodies would be constant and would continuously perform for heating and evaporating exactly according to the designer's plans without further control. However, modern continuous processing notwithstanding, the thin juice supply fluctuates. Accordingly, as the level of the juice in the supply tank drops from the maximum at the rim to the minimum cover of the pump suction, (3), its position provides the impulse to throttle the cold water supply to the condenser so as to raise the vapor pressure in the 5th body from the minimum of about 2 psi. abs. to the maximum of about 8 psi. abs. (4), thereby reducing the temperature difference and thus checking the rate of evaporation. At the same time an impulse from the vapor pressure in the first body, (5), which tends to rise when the condenser water supply is reduced, acts to throttle the steam to the first heating surface.

WITHOUT vapor extraction, from the 1st, 2nd and 3rd bodies, the controls thus far mentioned would suffice. That is, the thin liquor supply as influenced by the thick liquor discharge, the level control of the liquor and the steam supply induced by the control of the water to the condenser.

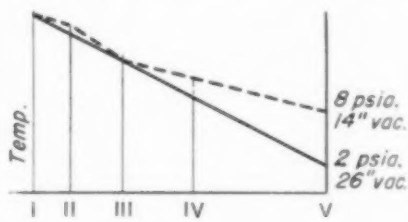
However, the use of these vapors requires constant pressures although the demand fluctuates. The first vapor



QUINTUPLE EFFECT EVAPORATOR CONTROL

pressure is maintained by controlling the supply of steam as noted above. The 3rd vapor pressure is similarly held constant by a pressure impulse (from the 3rd vapor), (6), that is relayed to operate a valve in the vapor pipe from the 2nd body to the 3rd. The set point on the dial for the control of this pressure (being about 4 in. of vacuum) as well as the set points of the 1st body pressure and the liquor levels in all the bodies, are determined by operating the evaporator at maximum capacity with all valves open.

IF THE PRESSURE in the 3rd body tends to depart from the set point of, say, 4 in., the valve in the 2nd vapor pipe will be positioned to prevent departure. The 2nd vapor pressure does not ordinarily require control as the rise at minimum speed is slight. The graph visualizes the conditions.



DURING MINIMUM evaporation only enough thin liquor enters to provide steam for extraction from the first three bodies and to maintain the level for the small evaporation that takes place in the 4th and 5th bodies. In case the liquor level in the thin juice supply tank tends to drop below the minimum point (i.e., to keep the pump suction covered) this level acts as the impulse, (7), to admit water into the tank. A supply tank of large capacity eases the fluctuations in operating conditions and reduces the frequency of water injection.

EXHAUST STEAM FLOW to the 1st heating surface, as stated above, is controlled by the impulse of the pressure of the vapor in the juice space of the 1st body. This pressure is affected by the pressure in the 5th body, as controlled by the water injection to the condenser. And this in turn is influenced by the quantity of thin liquor in the supply tank. The instrument that controls the condenser injection valve is set to maintain maximum vacuum, i.e. a pressure of about 2 psi. abs. As the level in the thin juice supply tank recedes, an impulse of this level adjusts the set of the condenser control instrument, (4), so that the water supply is throttled and the pressure approaches 8 psi. abs. as the liquor level drops to minimum. At this point the temperature gradient in the last

two bodies is too flat to effect evaporation.

RISING PRESSURE in the steam supply to the evaporator above the set point, i.e. in the plant exhaust steam system, delivers an impulse to open a relief valve, (8), to the atmosphere. On the other hand if the pressure drops below standard, live steam is admitted to the exhaust steam system (9).

SPEED OF EVAPORATION is promptly controlled by the water supply to the condenser. Accordingly the thick juice as well as the tail water attained a higher average temperature and there is a lesser demand for cold water than is the case under manual control.

"ZIEG" and his side-kick, Bob Reynolds, installed five of these controls during the past autumn and acquired acquaintance with sugar house behavior. After the boys had made all of the adjustments at the Nampa, Idaho, factory and the plant had run smoothly for a couple of days, they took an hour off and relaxed in the village tavern. On their return they observed a great cloud of exhaust steam above the roof and Superintendent Verne Finlayson, harassed by a raw crew, was tearing his hair and waving the disaster signal. Zieg started diagnosing with "anybody hurt?" and Bob chipped in with "make a mess on the floor?" Other questions in quick succession to ferret out the evil influences disclosed nothing of calamitous nature. Nothing worse had happened than a blast of steam to the atmosphere occasioned by the shutting off of first vapor to the pan during a period of low evaporation rate, and the blast refused to subside even after the condition had changed. Directly Verne sensed the absurdity of his worries and the wrinkles dropped from his forehead to the corners of his eyes.

The mystery continued for two hours and then it was found that a witless farmer had manipulated an obscure bypass valve in his impulsive eagerness to be helpful. In earlier years unfathomable mysteries were dismissed with the declaration that "it musta been the chemist." In this case the cause was a "valve termite," present in every sugar house. The action indicated a novice in the art. The experienced termite would have surreptitously replaced the valve in its original position and thus transferred the blame to the pixie.

AT THE NEIGHBORING Paul factory the boys happened to be disporting themselves right in the trajectory of the head of a juice heater at the

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instant when an explosion occurred due to the operation of a new high-head pump and a valve termite. They met the explosion like soldiers. Bob facing the attack, suffered a brand below the navel, while Zieg in retreat lost a patch of skin that had adhered to the back of his shirt. The boys returned from first aid to their job in front of the evaporators dressed for the most part in a G string just at the inopportune moment when two attractive young women came prancing through the works. In Caro in 1900 such an accident would have provoked Charlie Sieland's wagging finger accompanied by his famous remark, "Everything is going to hell for the want of neglect."

AT ANOTHER of Zieg's jobs a valve termite observed that the opening of an innocent valve wheel which projected through the floor in front of the evaporator, perplexed the foreman and caused distress. The termite had a desire to correct his error but without publicity. With hands in his hip pockets, he backed up nonchalantly against the wheel while wig-wagging his head to simulate attention to the evaporator gages, though actually guarding against disclosing his purpose. With his rump pressed against the wheel and his hands acting as a pawl, he ratcheted the valve into the closed position by oscillating after the manner of a man relieving an itch. Directly the foreman's excitement subsided and the matter would have been passed over as "one of those things." However, just at this moment Zieg happened to be poised unobserved with his telephoto camera on a platform above and behind the termite. The light conditions required a time exposure. The resulting print shows the termite without a head but his shoulders and feet and the valve are sharply outlined. The hips cover an excessive width as the camera caught the entire amplitude of oscillation. Zieg avers that the picture proves that the termite has a conscience but he has no head and he aims to operate anonymously.

A CRACKPOT from the lunatic fringe of the Southern Metropolis called on Spreckels' General Chemist Alston and expressed a desire to visit the refinery. His obsession was raw food and his zeal for the salvation of humanity was of such a degree of intensity that he expounded over the air. Refined sugar was poison. Only raw sugar as produced by Nature and threshed in sanitary mills was fit for human consumption. As Alston conducted the consequential visitor through the works, they came upon a

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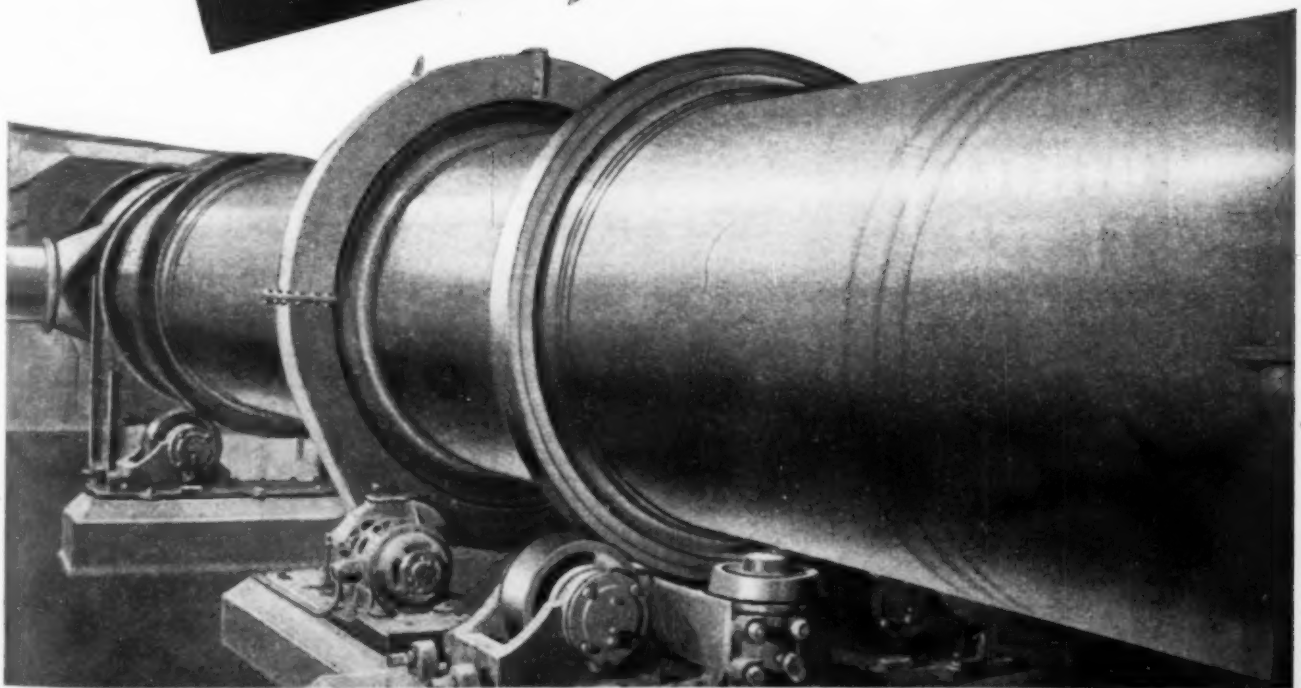

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dismantled pipe, long unused. This circumstance contributed an aroma of butyric acid fermentation, which is the most unforgettable stink that a sugar chemist can evolve. When the visitor recovered, Alston explained that that was the dirt they took out of the raw sugar.

On the other hand Bill Hoodless employs a ready device for discouraging desire for rawness. He focuses the laboratory microscope on one of Nature's innocent and harmless mites who also has a prejudice against refined foods. Then he invites the addict to gaze upon the monster multiplied horrendously to the proportions of an elephant.

JAMES D. DOLE left Harvard with a bachelor's degree in '99 and returned to the family farm in Hawaii. The home town paper featured his research in the culture and processing of pineapple and disparaged the waste of such promising youthful talents on a matter that had proven a failure ten years earlier. The "failure," as everyone knows, developed into the Island's greatest industrial activity next to sugar. Dole's research assistant described in the public press a novel procedure for recovering certain values from the pulp heretofore discarded. Some years later a Cleveland lawyer demanded that Dole cease and desist from infringing on his client's patent, a copy of which accompanied the demand. The important claims in this patent followed exactly the phraseology of Dole's process description, including certain typographical errors!

VARIOUS INHIBITORS of the time honored practice of pilfering have been exposed in this column, including the dosing of attractive brass machinery parts with finger-staining silver nitrate and the tempering of a stolen bottle of rum with a powerful physic. Another device was applied to a witless janitor in a large Marcus Hook laboratory. He was suspected of abstraction of phenol solution from the laboratory supply for beverage use, and evidently long habit had atrophied the cathartic effect. It was of course possible to fire the janitor but good janitors were at a premium during the war. Accordingly one of the boys, affecting a most serious demeanor, informed him under the strictest injunction of secrecy that it was suspected that someone was illegally withdrawing phenol. To improve the effect of the solution a very dangerous poison was to be added. The janitor was told to perambulate along the spooky banks of the Delaware River after dark. If he saw a corpse he was to push it into the river and forget it.

NAMES IN THE NEWS

C. C. Peavy

R. F. Evans

R. M. Lawrence

Claude C. Peavy has been appointed chief engineer of the Houdry Process Corp. Before joining the company a year ago he worked for E. B. Badger & Sons Co. and the Socony-Vacuum Oil Co. in various phases of petroleum refining engineering.

Donald G. Vaughan has been appointed manager of the engineering and inspection department of the Aetna Casualty and Surety Co.

Marston Taylor Bogert has been elected Honorary Member of the Association of Consulting Chemists and Chemical Engineers. Dr. Bogert is the first honorary member of the Association.

Norman A. Nielsen, metallurgical engineer in the engineering research laboratory of the Du Pont company's experimental station, Wilmington, received the 1946 Young Authors Prize of the Electrochemical Society in Louisville last month.

Garrett B. James, Sr., has become chief engineer for W. H. Markham & Co., an insurance brokerage firm in St. Louis, Mo. For the past four years he has been fire protection and insurance engineer for Monsanto Chemical Co.

Albert M. Mattocks, Jr., has been appointed associate professor of pharmaceutical chemistry at Western Reserve University. He is a former research chemist at Southern Research Institute, Birmingham, Ala.

Raymond F. Evans has been elected president of the Diamond Alkali Co., Painesville, Ohio. He succeeds **John T. Richards** who is retiring as president and board chairman.

Walter P. Hohenstein of the Polytechnic Institute of Brooklyn is in Rehovoth, Palestine, to supervise the installation of equipment at the new Weizmann Research Center.

M. F. Gribbins has been appointed a member of the technical service section of the ammonia department of the Du Pont company, Wilmington, Del. He has been a member of the chemical division of the ammonia department staff at the Du Pont Experiment Station since 1942.

Edgar A. Thronson has been appointed assistant director of the technical division of the Electrochemicals Department of the Du Pont company. Until recently he has been a special assistant to the director of the technical division.

J. G. Tolpin has been appointed to the position of editor of foreign technical information in the development and patent department of Standard Oil Co. of Indiana. Formerly he was editor of the Survey of Foreign Petroleum Literature.

B. E. Lauer has been made acting head of the department of chemical engineering for the coming year by the University of Colorado, Boulder, Col.

Richard M. Lawrence has been added to the staff of the development department of Monsanto Chemical Co. Prior to his appointment at Monsanto he was with the development department of Atlas Powder Co. and with the Chemical Division of the U. S. Tariff Commission.

Glenn T. Seaborg has been named consultant in nucleonics to the General Electric Research Laboratory, Schenectady, N. Y.

Frederick G. Hess has become assistant secretary of E. I. du Pont de Nemours & Co., filling the position vacated by **Merrett D. Fisher** who retired after 44 years with the company.

Theodore F. Freed has been appointed general manager of the Read Machinery Division, York, Pa., to succeed **James T. Duffy, Jr.**, who has resigned. Mr. Freed has been executive vice president and a director of The Standard Stoker Co. since its merger with the Read Machinery Co.

Wendell M. Stanley received the thirty-sixth award of the Willard Gibbs Medal from the Chicago Section of the American Chemical Society on May 23. Dr. Stanley is working with the Rockefeller Institute for Medical Research.

C. W. Walton, research chemist associated formerly with Goodyear Tire and Rubber Co. has now joined the Minnesota Mining and Manufactur-

ing Co., St. Paul. He will act as assistant to vice president R. P. Carlton who is in charge of production, engineering, research and development.

Clifford F. Rassweiler, vice president for research and development of the Johns-Manville Corp., has been chosen chairman-elect of the American Chemical Society's New York Section.

J. W. Hammesfahr has just joined the technical engineering department of the General Tire and Rubber Co. For the past three years he has been in the Navy overseas, as a technical liaison officer.

John D. Garber has joined the E. M. Wanderman & Co., Brooklyn, N. Y. as research director. For the past three years he has been research chemist with the chemical division, Standard Oil Development Co.

Harold A. Hoppens of the Plaskon Division of the Libbey-Owens-Ford Glass Co. has been elected chairman of the Toledo Section of the American Chemical Society for 1947-48. He succeeds **Albert A. Dietz** of the Toledo Hospital Institute for Medical Research.

G. H. Langsdorf

Gaynor H. Langsdorf has been elected a vice president and director of Oronite Chemical Co., in charge of products and processes. He has been manager of technical services in the manufacturing department of the Standard Oil Co. of California, Oronite's parent company.

Linus Pauling of the California Institute of Technology received the Theodore William Richards Medal of the Northeastern Section of the American Chemical Society in Cambridge, Mass., on May 8.

Samuel Colville Lind of the University of Minnesota Institute of Technology gave the 1947 Remsen Me-

morial Lecture on May 23. The lecture was the second in a series inaugurated last year by the Maryland Section of the American Chemical Society. Dean Lind's subject was "Fifty Years of Atomic Research."

Daniel S. Dinsmoor, vice president of Monsanto Chemical Co. and general manager of the company's Merrimac Division with headquarters at Everett, Mass., resigned last month to enter the chemical consulting profession. Succeeding Mr. Dinsmoor as general manager of the division will be **Josiah B. Rutter**, now director of the general engineering department. Mr. Rutter, in turn, will be succeeded by **Fred G. Gronemeyer**, who is at present assistant director of the general engineering department.

Hugh C. Minton has been made production manager of the Koppers Co., Pittsburgh. During the War he was director of the Army Service Forces' production division.

W. Z. Friend

Wayne Z. Friend has been appointed assistant section head of the corrosion engineering section of the development and research division of the International Nickel Co.

Paul J. Flory, research chemist of the Goodyear Research Laboratory, Akron, was presented with the Baekeland Award of the North Jersey section of the American Chemical Society on May 12. He was honored for his contributions to the fundamental chemistry of high polymers.

Martin Kilpatrick has been named chairman of the department of chemistry at Illinois Institute of Technology. During the war he served as assistant to Harold C. Urey, director of research, on the atom bomb project at Columbia University.

H. B. Walker, formerly with Rohm & Haas as research supervisor in charge

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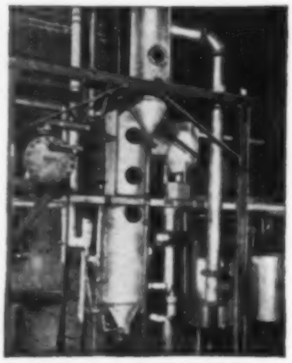


Silicon bronze alloy calandria unit and flash chamber, used with cyclotron.

of development of textile chemicals and leather finishes, and of the physico-chemical and physics laboratories, has been chosen as assistant to R. H. Patch, vice president in charge of operations, E. F. Houghton & Co.

Leroy F. Marek has been elected vice president of Arthur D. Little, Inc., Cambridge, Mass. He has been for several years in charge of chemical engineering activities in the company.

Melvin J. Killian has been appointed technical director of the Kalamazoo, Mich., paper mill of the St. Regis Paper Co. Mr. Killian formerly was control supervisor and pulp mill superintendent for the Combined Locks Paper Co.

Malcolm W. Reed has been elected engineering vice president of Carnegie-Illinois Steel Corp.

E. R. Rushton has joined the staff of the Institute of Textile Technology as assistant editor. Prior to coming to the Institute, he was with the Tennessee Valley Authority as a research chemist.

Max A. Bradshaw, who was with the Department of Agriculture for a number of years and served overseas as a major during the war, is now back in Germany serving as an assistant chief in FIAT.

Robert M. Evans has been appointed manager of the industrial division of the Du Pont plastics department, succeeding **Edsall R. Johnston** who has retired because of ill health.

William R. Diver has accepted a post as director of production of the industrial division in the Du Pont plastics department and **Edward R. Hagan** has been appointed to succeed him as manager of the Arlington, N. J., Works. Mr. Hagan's former position, that of assistant works manager, is now being filled by **Carl C. Ours**, production superintendent at Arlington.

Vincent J. Calise has joined the Liquid Conditioning Corp. of Linden, N. J. in the capacity of technical manager.

Richard H. Peeters has been appointed calendar superintendent of the Kalamazoo, Mich., mill of the St. Regis Paper Co.

Stanley Bracken has been elected vice president in charge of operations of the Western Electric Co., New York, N. Y., to replace **William F. Hosford** who has resigned. **H. C. Beal**, engineer of manufacture, will succeed Mr. Bracken as vice president in charge of manufacture **F. J. Feely** will become

engineer of manufacture in addition to managing Western Electric's Buffalo shops and electronic shops.

Leo I. Dana, research manager of the Linde Air Products Co., New York, has been presented with the Jacob F. Schoellkopf Medal of the American Chemical Society's Western New York Section. The Medal was awarded to Dr. Dana for his contributions to cryogenics, the science of very low temperatures.

Raymond F. Evans has been elected president of Diamond Alkali Co., Pittsburgh, Pa., to succeed **John T. Richards** who is retiring after 30 years with the company.

Earl R. Olson, chemical engineer, has been named to the staff of Battelle Memorial Institute, Columbus, where he will engage in research on the engineering properties of materials.

Carl S. Miner, of Miner Laboratories, has been elected to the board of directors of Universal Oil Products Co., Chicago.

Onslow B. Hager has been appointed director of research and development at the Alco Oil and Chemical Corp., Philadelphia, Pa. Formerly he was with Rohm & Haas Co. where he worked with textiles.

Ralph Hoeckelman has been appointed to the research staff of Battelle Institute, Columbus, Ohio.

Edward G. Boyer has been awarded the Clark medal in consideration of his contributions to the gas art. He is the manager at the Philadelphia Electric Co.'s gas department.

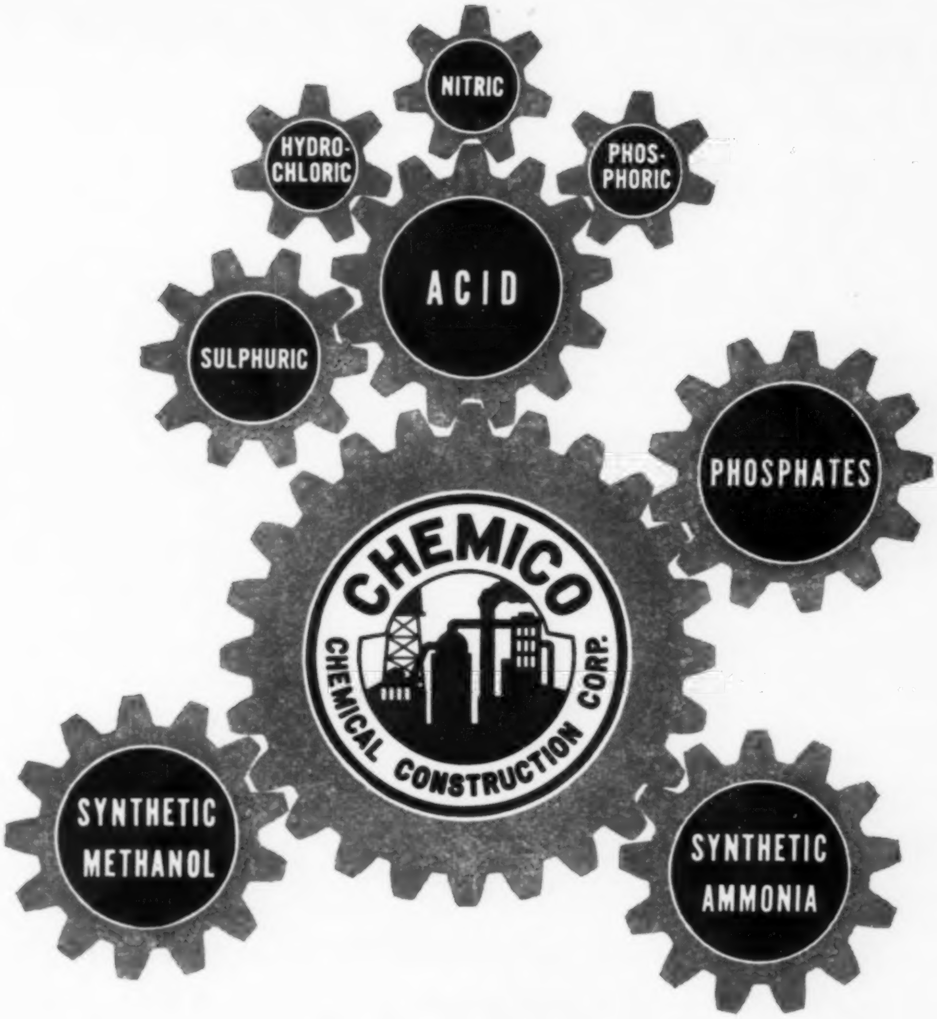
H. L. Haller has been appointed special assistant to the chief of the Bureau of Entomology and Plant Quarantine. He has been assistant leader of the Bureau's Division of Insecticide Investigations since 1937.

OBITUARIES

Eli Reed Ohl, 54, secretary-treasurer of the Independent Explosives Co. and of the Chemex Supply Corp. of Cleveland, died in Cleveland May 5.

Thomas C. Oliver, 65, retired vice president of the Chemical Construction Corp., New York, died in his summer home at Shelter Island Heights, L. I., May 14.

William H. Ross, 71, retired fertilizer chemist of Department of Agriculture died after brief illness in Washington, D. C., May 16.



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INDUSTRIAL NOTES

B. F. Goodrich Chemical Co., Cleveland, has changed the address of the West Coast sales office to 714 West Olympic Blvd., Los Angeles, Calif. R. E. Bitter is in charge of the new office.

Corning Glass Works, Corning, New York, has formed an eastern sales district in New York City. Charles L. Day will be in charge.

Farris Engineer Corp., Palisades Park, N. J., has appointed Paul Robinet sales manager.

Kellogg Corp., New York, has elected H. R. Austin president of the Kellex Corp., a subsidiary, to succeed M. W. Kellogg who was elected chairman of the board.

American Car and Foundry Co., New York, has appointed John F. Considine district manager of the Chicago plant.

Atlantic Powdered Metals, Inc., New York, has named H. Dann production manager and L. Faller sales manager.

E. I. du Pont de Nemours and Co., Wilmington, Del., has appointed P. R. Brown assistant director of sales of the rayon division. F. H. Coker is now assistant sales director of the nylon division. F. F. Hubach was transferred to Philadelphia and D. L. Lewis, Jr., becomes manager of the Charlotte, N. C., district.

Borg-Warner Corp., Chicago, Ill., has appointed John Gulick manager of the Chicago office of Borg-Warner International Corp. George P. F. Smith, president of Marbon Corp., was elected vice president of Borg-Warner Corp.

United States Steel Corp., New York, has elected J. Lester Perry president of Columbia Steel Co., a West Coast subsidiary.

Laclede-Christy Clay Products Co., St. Louis, Mo., has appointed Paul J. Maddox general sales manager of the refractories division.

Hays Corp., Michigan City, Ind., has named Shirl M. Rudolph vice president in charge of sales and William H. Pugsley vice president in charge of field research.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has named A. D. Robertson

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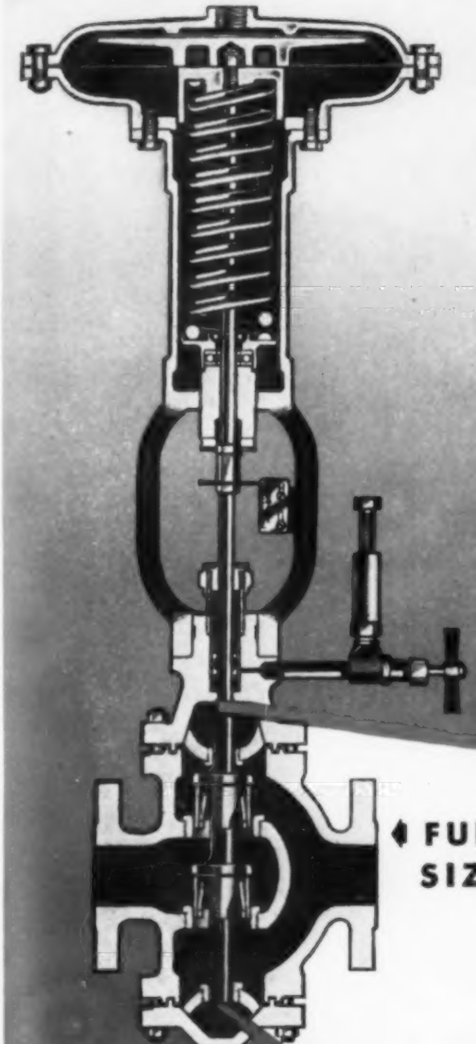
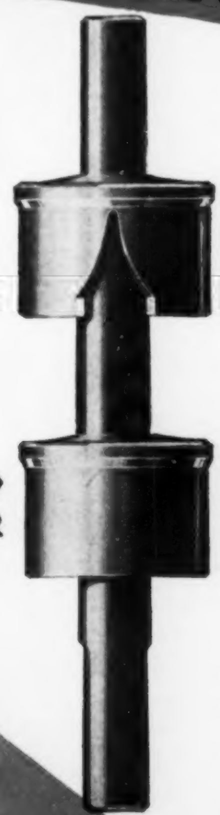


FULL SIZE

1 SIZE SMALLER



2 SIZES SMALLER

PRACTICAL

For example, a 4" valve can quickly be converted to flow capacity of a 3" 2½", or 2" size. This is accomplished by the restricted V-Port Inner Valve alone—without changing seat rings. Inner valves with equivalent smaller size valve area or capacity are fully interchangeable with standard full size inner valves. Inner valve skirts are cast stainless steel with wide range percentage characteristics port areas. Cast skirts are welded on to stainless steel bar stock center post guide. Further details and application data gladly furnished on request.

FISHER GOVERNOR COMPANY MARSHALLTOWN, IOWA

manager of the Tampa, Fla., district office and Arthur D. Brown manager of the Washington, D. C., office.

Trent Tube Mfg. Co., East Troy, Wis., has elected Walter H. Wiewel president to succeed F. E. Elge who is now executive vice president and a director.

Dampney Co. of America, Boston, has named Combustion Equipment & Insulation Co., Cleveland, Ohio, agent in that area.

Okonite Co., Passaic, New Jersey, has named Edward A. Damrau manager of the new branch office at 601 Chamber of Commerce Bldg., Charleston, W. Va.

Michiana Products Corp., Michigan City, Ind., has appointed John H. Staiger representative at 80 West Jackson Blvd., Chicago, and William A. Zach representative in the Indiana territory with offices at the Michigan City plant.

Mixing Equipment Co., Rochester, N. Y., has named White Industrial Sales & Equipment Co. of Akron and Cleveland as district representatives in the state of Ohio.

Westcott and Mapes, Inc., New Haven, Conn., has appointed Elias I. Kelsey chief of the industrial engineering division.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has opened a new office in the Phoenix Bldg., Butte, Mont., with James A. Reynolds as manager.

B. F. Goodrich Co., Akron, Ohio, has announced that the new $4 million plastic plant in Westview, Ohio, will begin operations early this summer. B. S. Taylor is plant manager.

General Electric Co., Pittsfield, Mass., has announced the beginning of equipment installation at the newly purchased factory for plastics molded parts at Decatur, Ill.

Chapman Valve Mfg. Co., Philadelphia, Pa., has moved to new quarters in the Liberty Trust Bldg., Broad and Arch Sts., Philadelphia.

Westvaco Chlorine Products Corp., New York, has appointed W. Newall Wyatt division sales manager in charge of dry cleaning specialties and industrial solvents in New York.

Fritzsche Brothers, Inc., New York, has announced the opening of a new

International
MIXERS AND KETTLES
Complete with Tank and Drive Unit in various types and sizes, with any style stirrers, propellers or turbine.
PERMANENT AND PORTABLE MIXERS
RIBBON MIXERS
Belt or Motor Driven.
SIDE ENTRANCE MIXERS
1/2 to 25 H. P. Sizes; Repacked from outside.
DRY BLENDERS,
BALL AND PEBBLE MILLS
CATALOG
On Mixers, Agitators, Blenders, Ribbon Mixers, etc., No. 110. Now ready.
CATALOG No. 85 on BALL MILLS—Either catalog or both sent on request.
INTERNATIONAL ENGINEERING, INC., DAYTON, OHIO
NEW YORK—15 Park Row
CHICAGO—407 S. Dearborn St

branch office at 2208 Main Street, Dallas, Tex. C. H. Milton, Jr., is manager.

Laclede-Christy Clay Products Co., St. Louis, Mo., has appointed N. C. Michels chief engineer. E. H. Krautheim is assistant chief engineer in charge of plant engineering and maintenance and Les Mueller is assistant chief engineer of the arch and wall division.

Westvaco Chlorine Products Corp., New York, has named D. C. Oskin division sales manager in New York and A. L. Crane district sales manager at Detroit.

Hagan Corp., Pittsburgh, has transferred W. H. Stewart to the Pittsburgh office as sales engineer for combustion control and boiler water conditioning.

Stein, Hall & Co., Inc., New York, has announced the election of Morris S. Rosenthal, executive vice president and director, president of the National Council of American Importers. Lawrence Gussman has been elected vice president in charge of manufacturing.

Wilmington Chemical Corp., Wilmington, Del., has transferred its main sales office from New York to 1 South Heald St., Wilmington.

Automatic Transportation Co., Chicago, has named J. A. Baldinger assistant to the general manager.

Ceco Steel Products Corp., Chicago, has announced George R. Wernisch, manager of the steel joist and roof deck division, was elected president of the Steel Joist Institute. James D. Maitland of Colorado Builders Supply Co., of Denver, was named vice-president.

Marley Co., Inc., Kansas City, Kan., has appointed Charles B. Briggs, Jr., production manager.

Monsanto Chemical Co., St. Louis, Mo., has appointed F. A. Abbiati assistant general manager of the plastics division. James R. Turnbull succeeds him as general manager of sales. Charles Lichtenberg will be assistant general manager of sales.

Ampco Metal, Inc., Milwaukee, Wis., has announced the appointment of J. B. Ripley Brass Foundry of Windsor, Vt., as their licensee in that area. John C. Fitzpatrick Co., Toronto, Ontario, is sales agent in that province.

Goodyear Tire & Rubber Co., Akron, Ohio, has named Donald W. Neese

sales representative in New York City for the plastics and coatings department.

Babcock & Wilcox Co., New York, has elected Anthony M. Kohler and Alan E. Phin vice presidents.

Henry Disston & Sons, Inc., Philadelphia, has elected Jacob S. Disston, Jr., president. S. Horace Disston was advanced to chairman of the board.

Diamond Alkali Co., Pittsburgh, has elected John A. Sargent vice president in charge of finance.

Carborundum Co., Niagara Falls, N. Y., has announced the appointment of Clarence E. Hawke director of domestic sales; Edwin B. Forse, manager of the refractories division at Perth Amboy; Boyd H. Johnson, manager of refractories sales at Perth Arboy and Russell G. Albertson, division manager Canadian **Carborundum Co., Ltd.**, Niagara Falls, Ontario.

Ladish Co., Cudahy, Wis., has appointed H. L. Pehrson manager of West Coast sales with offices at 714 West Olympic Boulevard, Los Angeles, Calif.

Midvale Co., Philadelphia, Pa., has elected Richard T. Nalle president. He succeeds Francis Bradley who has been elected chairman of the board.

Elliott Co., Jeannette, Pa., has appointed F. Q. Wilson, Jr., district manager.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has appointed George L. Smutny food industries representative of the general machinery division.

Acme Rubber Mfg. Co., Trenton, N. J., has named L. J. Amsdell eastern sales manager with headquarters in the New York Office at 233 Broadway.

American Brake Shoe Co., New York, has appointed Homer Parsons director of exports. Kempton Dunn was elected secretary.

Mixers, Inc., Philadelphia, Pa., has appointed Edwin W. Ritter designing engineer in charge of new development and production.

Corning Glass Works, Corning, N. Y., made the following executive changes. Eugene W. Ritter, vice president and manager of the consumer products division becomes president of Corning Glass Works of South America. His headquarters will be at Buenos Aires, Argentina. Benjamin S. Peirson, for-

merly division general sales manager takes Mr. Ritter's place. Robert S. Beattie replaces Mr. Peirson. D. Kenneth Shaddock, manager of the plant at Central Falls, R. I., becomes manager of pressware division at Corning and James L. Knapp, production superintendent of Central Falls, has been appointed manager of that plant.

Johns-Manville Corp., New York, has added Robert J. Cornell and George F. Huber to the Celite division as sales engineers.

Titan Metal Mfg. Co., Bellefonte, Pa., has appointed Frobes Co., Salt Lake City, Utah, sales agents for Idaho, Nevada, Wyoming and South Dakota area.

Simplex Valve & Meter Co., Philadelphia, Pa., has appointed Frank E. Gerlitz, Jr., sales manager.

Jessop Steel Co., Washington, Pa., has appointed A. J. Fischer manager of the Carbide and Cast Alloy division.

Bunell Machine and Tool Co., Cleveland, Ohio, has appointed the following district representatives: State Machine Tool Co., 1441 North Third St., Milwaukee, Wis.; Herbert K. Baker, 3020 East Grand Blvd., Detroit, Mich.; Triplex Machine Tool Corp., 125 Barclay St., New York City.

St. Regis Sales Corp., New York, has announced the opening of a sales office at 318 Martin Brown Bldg., Louisville, Ky., under the supervision of Charles C. Keefer.

Pennsylvania Salt Mfg. Co., Philadelphia has added John H. Schneider to the sales service staff of the special chemicals division.

Falk Corp., Milwaukee, Wis., has appointed D. S. Ferree district manager of the new Philadelphia sales office at 505 Race St.

General Box Co., Chicago, Ill., has transferred J. A. Cragwall to the Kansas City, Mo., division as manager.

Chandler Laboratories, Inc., Philadelphia, Pa., has announced the completion of their plant at Eighth St. and Chelten Ave.

Bailey Meter Co., Cleveland, Ohio, has assigned R. L. Stewart to Denver office, L. E. Bartel to Kansas City and G. D. Williams to the Atlanta office.

Sage Equipment Co., Buffalo, New York, has increased their production facilities by acquiring new quarters at 30 Essex St., Buffalo.

CONTENTS

Prospective Pacific Northwest Power Requirements

Sales of the Bonneville Power Administration have increased between fifty and seventy-fold during the past nine years. Generating capacity has increased from roughly 100,000 kw. at Bonneville Dam in mid-1938 to a total "name-plate rating" of 1,176,400 kw. at Bonneville and Grand Coulee Dams.

The expected slump in power use upon cessation of hostilities did materialize in the region, but was of surprisingly short duration. At the present time, the demand on the Bonneville-Grand Coulee system is so great that all equipment is being used to full capacity, without reserves. And the region is clamoring for more power.

The growth of electric power consumption in the Pacific Northwest is indicative of what is happening to industrial and economic expansion in the region. In our Annual Report to the Congress for the fiscal year 1946, which ended in June of 1946, it was shown that during the period of maximum peak demand for that year of 1,346,000 kw., 44.7 percent of the capacity was utilized for Pacific Northwest industry on our system; 35.2 percent was utilized by the private power utilities of the region; 12 percent went for publicly-owned power utilities; and the remainder, 7.9 percent, was divided between requirements of military establishment and system losses. Further analysis reveals that of the total peak distribution, 37.3 percent was for aluminum production, 7.6 percent was for other major electropress industries.

Aluminum consumption in the United States—instead of collapsing as many skeptics proclaimed—has already expanded four to five times prewar loads—far beyond most optimistic estimates. The same general story applies to other electroprocess industries which located in the region during the war. Additional production of carbide, electrolytic iron, and chlorates is now under way. Numerous smaller industries have sprung up in every section of the area, adding to power consumption considerably.

Estimated primary and secondary aluminum production for 1947, after a short slump, may reach 1.7 billion pounds, with total actual demands of 2.3 billion pounds. In addition, the automotive and transportation field has not yet begun to make minimum feasible use of aluminum. Its feasible requirements alone, with lower primary costs of the metals and its fabrications, may require over 1 billion pounds per year. In other words, a total national aluminum market may develop, by 1960 or so, of 3 billion pounds requiring 30 billion kilowatt hours per year.

Production has slumped but preliminary studies make us confident that magnesium is going to go through a resurgence in importance which may be startling. This will be due to the development of new alloys, new fabricating methods, and the growing realization by industry of magnesium's significant advantages. By 1960, national magnesium markets may be as high as 300,000,000 lb. requiring 3 billion kilowatt hours per year.

In copper and zinc, electrothermal and electrolytic reduction power requirements have continued to climb. From about $\frac{1}{2}$ to $1\frac{1}{2}$ billion kilowatt hours per year during the period 1926-1939, these requirements reached almost 3 billion kilowatt hours in 1943.

For calcium carbide, chlorine and caustic, electrothermal steel, and other electroprocess industries, the story is pretty much the same: a steady rise prior to the war, rapid expansion during the war, and continued rise since the war. To these must be added numerous relatively new products of the electric furnace and electrolytic cell, such as metallic calcium, metallic lithium, metallic sodium, elemental phosphorus and electric furnace fertilizer, electrolytic iron, chromium and manganese, and chlorine derivatives such as chloroethylenes and DDT. These are industries in relative infancies and, as they grow, so will their national power requirements.

For the past year and a half, some of us at Bonneville Power Administra-

tion have been trying to visualize what industrial expansion might be expected in the Pacific Northwest by 1960. We have tried to interpret technological and market trends in some fifty groups of electroprocess and satellitic industries. We have tried to analyze markets—in the Pacific Northwest, on the West Coast, the Nation, and for export. Then we have attempted to fit those basic industrial facts to Pacific Northwest power, raw materials, markets, and freight-rate factors.

We believe that, given the power supplies, industrial use of power in the Pacific Northwest will double by 1960. The increase could occur in plant expansion and establishment for the needed national production of light metals, rolled and stainless steel, ferro-alloys, non-ferrous metals, nonmetallics such as abrasives, phosphorus and phosphates, and other electrochemicals. We feel confident that more than 1 million kilowatts could be used in the Pacific Northwest for this type of industrial development.

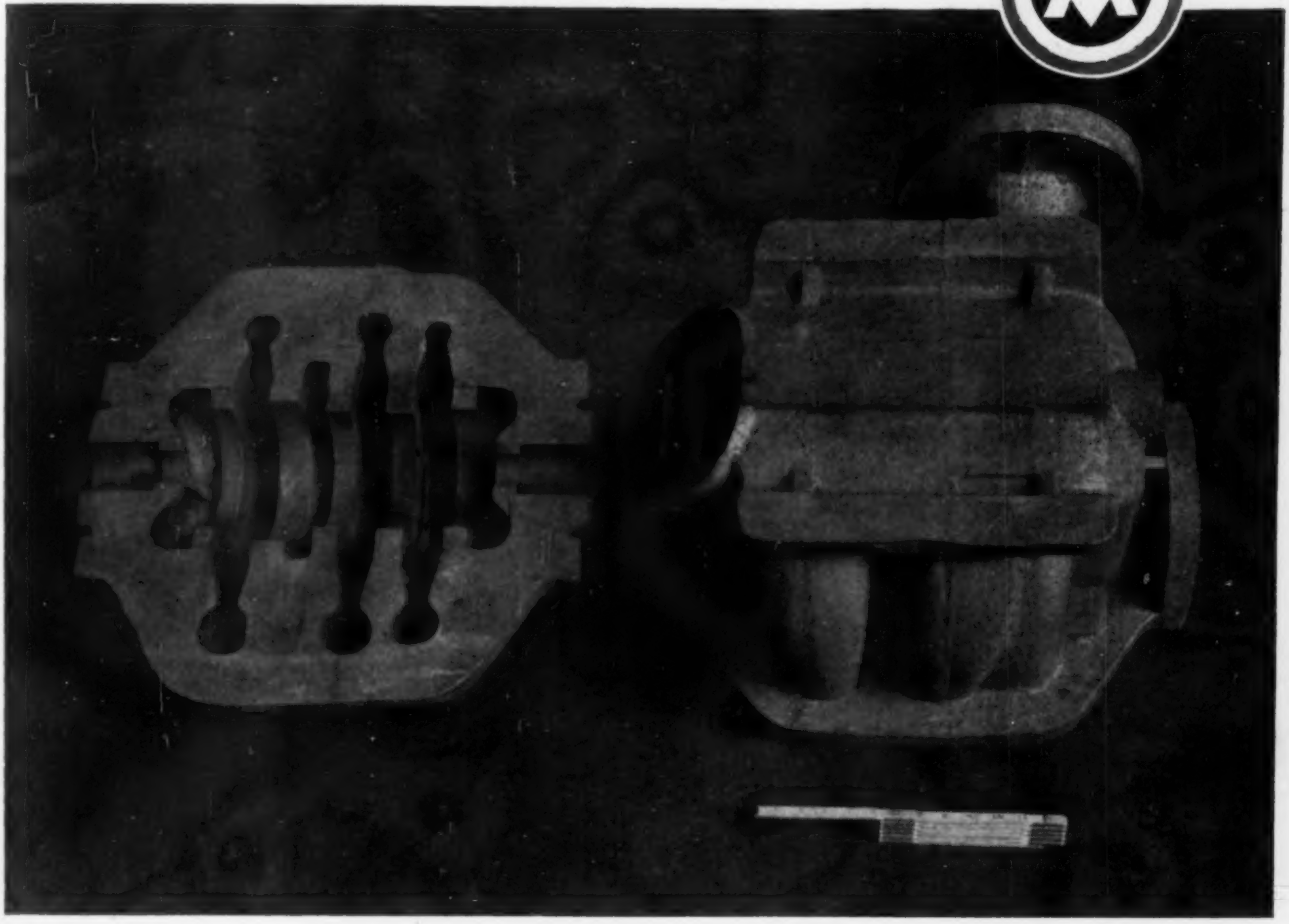
Ivan Bloch, Bonneville Power Administration, before the Chicago Section of the Electrochemical Society, Chicago, Ill., Apr. 4.

Statistical Attacks on Polymer Problems

In view of the immense practical importance of high polymers and their essentiality to living processes, it may seem surprising that it is only recently that they have become the subject of direct scientific investigation. Not until about fifteen years ago was the essential chemical nature of high polymers established. Instead of being colloidal aggregates of relatively small molecules which tended to stick together for some mysterious reason, it then became established that high polymers are giant chemical structures, and that their unique properties stem solely from the size of their molecular structures.

Monomeric substances are composed in each case of a single molecule; all of the molecules in such substances are the same when the substance is pure. Early investigators on high polymers erroneously expected them to be composed of a single characteristic molecule. It is now known that high polymers invariably are composed of numerous molecular species.

Even in the simplest of cases, the various long chain molecules will differ in length (i.e., number of units), and they cannot be separated perfectly by any known method. The fact that a given high polymer cannot be characterized by a single molecular constituent led to much confusion until it was realized that instead of trying



to separate the polymer into its individual molecular constituents (an as yet impossible task), it would suffice to compute from the laws of statistics the relative proportion of molecules of 1, 2, 3, 4, etc. units in the polymer mixture of molecules. Such calculations have proved highly successful and have obviated to a large extent the necessity of separating high polymers into molecularly "pure" fractions as a pre-requisite to their understanding.

The situation is even more complex in the case of copolymer, that is, a polymer formed from two or more monomeric units. Here the number of different kinds of molecules which may form is enormous beyond comprehension. To consider the well-known GR-S synthetic rubber copolymer, for example, it is unlikely that any two high polymer molecules in the many hundreds of thousands of tons so far produced are identical. In other words, every high polymeric GR-S molecule so far produced is different from every other one.

Mathematical statistics has proved to be the mainspring of the attack on high polymer problems. Nowhere is this better illustrated than in the study of gelatin. Whenever the polymer molecules can form in such a way as to give branched chains, the possibility of forming a network arises (something like an imaginary fishnet in three dimensions, if the net is hopelessly entangled and snarled). Such a network is hardly a molecule for it extends from one end of the material to the other, it is so large that the word "molecule" just doesn't fit anymore. Polymers of this sort include paint films, thermosetting resins, vulcanized rubbers and gelatine desserts.

Formation of polymers of the above type is characterized by a sharp gel point, after which the polymer is no longer fusible and soluble. Its strength and durability are increased, but it can no longer be molded into any other shape once gelation has occurred. The gel point has been identified as that point at which the continuous network structure begins to form. The deduction of the necessary conditions for inter-linking of units and chains is a statistical problem.

Paul J. Flory, The Goodyear Tire & Rubber Co., before North Jersey Section, American Chemical Society, Newark, May 12, 1947.

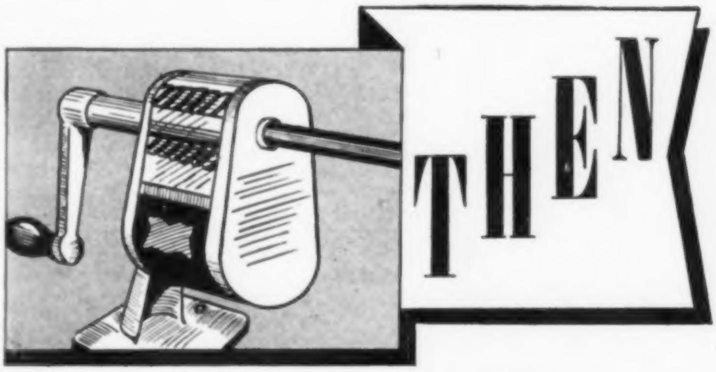
Properties of Allyl Starch Coatings and Films

THE PROPERTIES of coatings and films of allyl starch, a reaction product of starch and allyl chloride or allyl bromide, suggest that the material may be useful as a protective coating. It is soluble in a large number of

BATCHES NEED BOTH BLANKETING AND AGITATION

TOTAL PURGING-GAS REQUIREMENTS FLUCTUATE

SAFETY FORBIDS AIR IN STORAGE OR PROCESS VESSELS



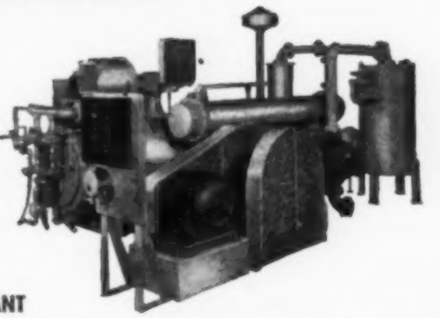
the situation calls for a KEMP "inert gas producer"

Here's why—in all three cases!

KEMP "inert gas" is so inexpensive that you can afford enough flow to agitate your batches (by bubbling) with the very same gas you use to blanket them. KEMP "inert gas producers", unlike others, are equally efficient from 20% to 100% capacity, and you don't pay full-load expenses for partial-load uses. KEMP "inert gas" can be piped, like a utility, throughout the plant, for ready attachment to any vessel or piece of equipment.

And KEMP "inert gas" is more than just the oxygen-free residue of complete combustion. Units which *also* remove carbon dioxide, or sulfur, or water vapor (down to dew points of −40°F), are everyday variants by KEMP to suit your special needs. A 99+% pure nitrogen by KEMP can be had at 76¢ per M cu. ft. (including amortization).

Of all the dozens of situations in the chemical process industries which call for inert gas protection—more cheaply, more automatically, and more controllably—which ones exist in *your plants?* We may have a helpful idea or two.



AT A MAJOR MID-WESTERN SYNTHETIC RESIN PLANT

. . . this KEMP 8-MIHE "inert gas producer" replaces a bottled CO_2 system at the job of blanketing synthetic resin batches, both during cooking and in storage. A 100 p.s.i. compressor delivers up to 8,000 cu. ft. per hr. of air-excluding protective gas to the various kettles and tanks throughout the plant.

Gas analysis: N_2—87%, CO_2—12.5%, $CO+H_2$—0.5%, O_2—none, H_2O—saturated at compressor inlet temperature. Operating cost (including amortization): 15¢ per M cu. ft. Requires no "nursing"; serves automatically; eliminates "bottle juggling."

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ATMOSPHERE GENERATION & ABSORPTIVE DRYER SYSTEMS FOR PROCESS CONTROL AND PROTECTION

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COMPANY________________

PLACE________________

organic solvents and a solution of 50 percent solids has a viscosity in the neighborhood of 1.5 to 2.5 poises. When suitably formulated, the lacquer is capable of drying free from tack in 5 min. and is sufficiently hard within 24 hr. at room temperature to permit sanding or rubbing. It may be characterized as an evaporative-drying, oxidative-hardening coating material. Coatings of allyl starch are also heat reactive; they can be cured in 2 to 4 hr. at 100 deg. C. and within 15 min. at 150 deg. C.

Air-dried coatings of unmodified allyl starch exhibit an abnormal tendency to shrink and crack within an hour after application. A shrinkage test has been devised which demonstrates that the addition of as little as 10 percent of a plasticizer prevents this shrinkage.

The tensile strength of cured films of the unmodified product is such that a 3- to 4-lb. weight is required to break a test strip 0.5 in. wide by 0.001 in. thick. Its elongation at break is approximately 6 percent. Modification with plasticizing resins results in considerable improvement in distensibility. For example, 2 parts of allyl starch to 1 part of non-drying alkyd resin yields a cured film which has good abrasion resistance.

T. J. Dietz, J. E. Hansen and M. E. Gallagher, Eastern Regional Research Laboratory, before Division of Paint, Varnish and Plastics Chemistry, American Chemical Society, Atlantic City, April 17, 1947.

Practical Process for Making Triptane

A LONG-SOUGHT goal of the petroleum industry, a practical process for making triptane, has been achieved. Actual commercialization of the process must await the development of aviation engines which require better fuel than any now in use, but the operating cost is low and triptane is recovered in high concentration. The process was discovered in 1943, but at that time the details could not be disclosed because of military secrecy.

The starting material is made from refinery gases by polymerization and hydrogenation. This starting material is a mixture of 2,2,3-trimethylpentane, 2,3,3-trimethylpentane and 2,3,4-trimethylpentane. This mixture is converted to triptane by a process called "selective demethylation" which consists of treating the mixture with hydrogen and a catalyst, preferably nickel or cobalt, at a temperature of about 500 deg. F. under pressure of 100 to 500 psi.

This treatment results in cutting the chain between the fourth and fifth carbon atoms. It is necessary to remove one particular carbon atom from

the chain. If any other atom were removed the resulting product would not be triptane.

It is interesting to note that of all the nine possible methods of arranging the 7 carbon atoms together with 16 hydrogen atoms, the triptane arrangement is the most compact and the characteristics of the fuel it produces are the most interesting. It is also a remarkable fact that triptane, noted for the highest octane rating of any motor fuel known, contains the same number of carbon and hydrogen atoms as normal heptane which is the zero in octane rating.

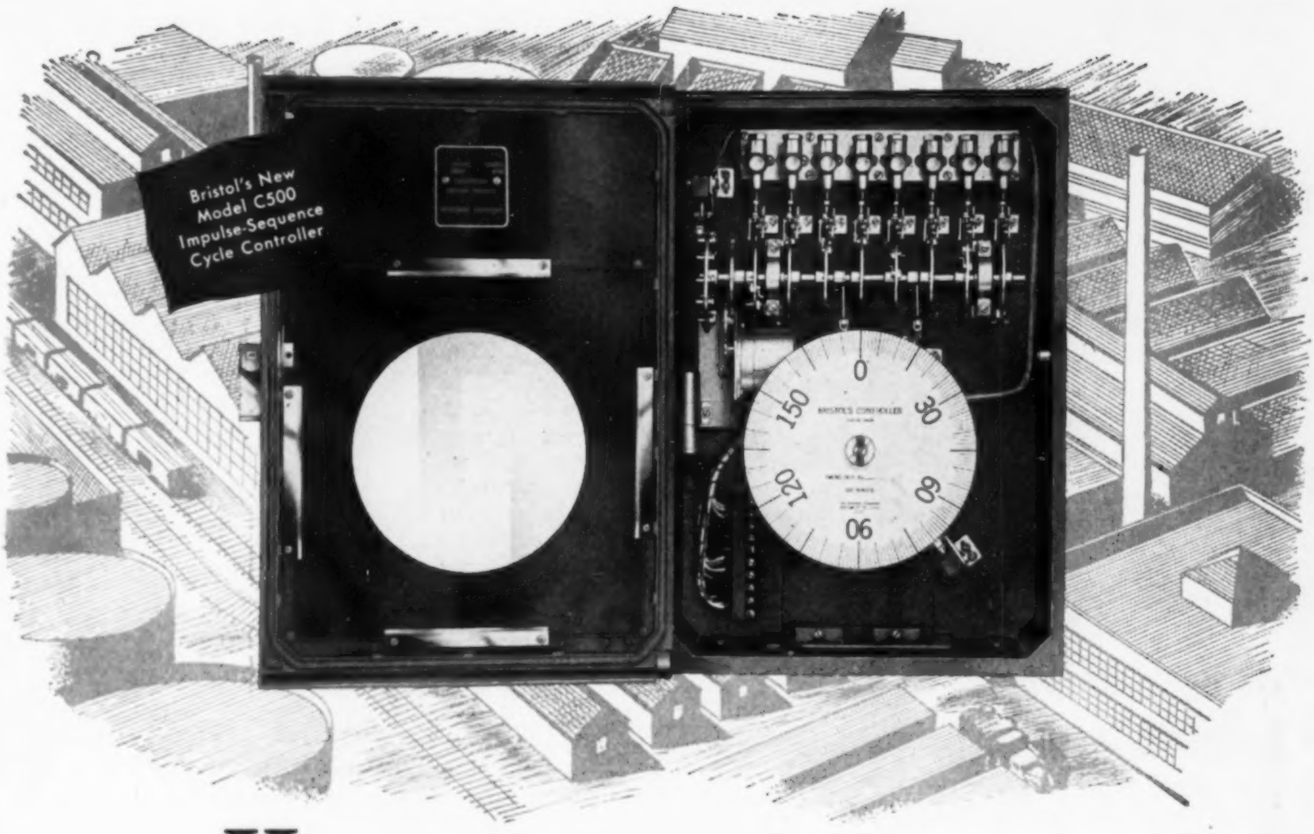
Vladimar Haensel and V. N. Ipatieff, Universal Oil Products Co., before the Division of Petroleum Chemistry, American Chemical Society, Atlantic City, N. J., April 17, 1947.

Production of Toluene Under Optimum Conditions

THE FEED stock chosen for toluene production was a well-fractionated straight-run gasoline boiling in the range 180 to 230 deg. F. obtained from California crudes. This cut contained methylcyclohexane which, upon dehydrogenation over the catalyst, produced the major amount of toluene in the process. A two-pass operation was used to purify the toluene. The first pass charged the 180 to 230 deg. F. straight run gasoline and produced a toluene concentrate for second pass feed. The second pass removed impurities in the toluene without use of any special purifying facilities, producing a nitration grade toluene containing less than one percent total impurities.

The catalyst developed showed two outstanding properties—high activity for production of toluene from the feed stock and ability to withstand the high regeneration temperature required. The laboratory work showed the optimum catalyst to be alumina containing about 8 percent molybdenum as the oxide, made into $\frac{3}{16}$-in. pellets.

Commercial reaction vessels were of multi-bed design to avoid high pressure drop and resultant high cost of circulating regeneration gas. Ten catalyst beds each 3 ft. deep in the form of an annulus of 40 in. inside diameter and 9 ft. outside diameter were provided in each reactor. The plant contained four of these reactors. Flow through the beds is vertically downward for both the reaction and regeneration periods. Feed enters the reaction vessel half way up the side and is distributed to the top of each bed through an annular space. Products pass to a central duct and leave the reaction vessel near the bottom. All internals in the reaction vessel are



Here's *Good News for Process Industries!*

... Bristol's New, Improved Model C500 Impulse-Sequence Cycle Controller Gives Closer Quality Control ... Improved Product Uniformity ... Lower Processing Costs — Through BETTER TIMING.

Bristol's new precision timing instrument contains many features that make it ideal for controlling cycle processing:

EXTREME TIMING ACCURACY ... timing mechanism and pilot valve mechanism are separately powered, electrically coordinated ... *timing mechanism does no work.* 25" time scale gives highly accurate timing.

EASE OF CYCLE SET-UP ... time intervals are set by notching a rigid aluminum disc. Cams that actuate pilot valves are adjustable quickly, accurately, simply ... *no fine adjustments or cam cutting needed.*

FLEXIBILITY ... controller can be quickly changed from one cycle to another by replacing timing disc and adjusting cams. *One controller may serve any number of operating schedules* by providing a properly notched disc for each. Controller can be arranged for 1 to 8 cams and pilot valves.

POSITIVE ACTION ... motor supplies high torque to operate pilot valves instantaneously ... *pilot valve operation is accomplished by direct cam action without gear shifts, clutches or relays.*

AUTOMATIC RESET ... after completion of the cycle, controller is automatically reset to the starting position *by positive motor drive.*

Bristol engineers will gladly show you how this remarkable new instrument will not only pay for itself ... but will pay *you* profits year after year in service. There's no obligation of course. Write: The Bristol Company, 109 Bristol Rd., Waterbury 91, Conn.

BRISTOL

Engineers process control for better products and profits

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

chrome-nickel steel, and essentially no corrosion has been experienced from the alternate oxidizing and reducing conditions employed in the process.

A. A. Burton, E. B. Chiswell, W. H. Claussen, C. S. Huey and J. F. Senger, California Research Corp., before the regional meeting of the American Institute of Chemical Engineers, St. Louis, Mo., May 12, 1947.

Responsibilities of the Chemical Engineer

Chemical engineers require a different type but the same high order of critical judgment used by other engineers in keeping plant operation at an efficient level. When engineers are given the responsibility of operating a plant, they must use good judgment in keeping the production units at a reasonable level of operation. This is readily appreciated by the layman in terms of motors, steam engines, turbines or other moving machines where a burnt-out bearing, a cracked piston, a broken fly wheel, may be the result of overloading. The chemical engineer is called upon to use the same kind of judgment in the production of chemicals. If the production rate is pushed too high, valuable time and money may result from chemicals which fail to meet specifications.

James Coull, University of Pittsburgh, and C. A. Bishop, Carnegie Steel Corp., before American Institute of Chemical Engineers, St. Louis, Mo., May 12, 1947.

Controlling "Slacker" Strains of Streptomycin Mold

Successive generations of the mold which produces streptomycin tend to develop modified forms, which yield less of the drug. This tendency seems to be conquered by the addition of small amounts of the pure drug.

If uncontrolled, the "slacker" strains of mold take up space and consume nourishment from the culture broth to the detriment of their better-producing brothers.

The end result of the controlled process was said to be a substantial increase in the total volume of streptomycin produced from a given quantity of culture, the amount being actually greater than that obtained from the fresh parent strain.

C. J. Christensen, F. J. Rudert, and Milton J. Foter, William S. Merrell Co., before the Division of Biological Chemistry, American Chemical Society, Atlantic City, April 15, 1947.

Consumption of Waste Pickle Liquors

Development of new speciality uses for pure synthetic finely divided iron oxides will certainly aid in the consumption of the waste pickle

Cylindrical Plug for full flow

Greater operating efficiency stems from the exclusive design of the a.c.f. Lubricated Plug Valve . . . providing a full pipe area through the ports . . . straight through uninterrupted flow. a.c.f. Valves are now also manufactured in Steel for difficult services. A new descriptive catalogue, S-46 (CM) awaits your request. American Car & Foundry Company, Valve Department, 30 Church Street, New York 8, N. Y.

American Car and Foundry Co.

Lubricated
PLUG VALVES

liquors now going downstream on the red side of the ledger.

For many years a certain amount of this iron salt solution has been converted to copperas, ferrous sulphate, by evaporation and crystallization processes. From these purified solutions iron oxide paint pigments and polishing rouge are made.

Another use of the pure iron oxides resulting from iron pickle liquor and the like has not received the attention it deserves, namely, the preparation of metallic iron powder from which many useful objects may be made through compression in molds, sintering in a reducing atmosphere, followed by coin pressing. The full utilization of this scheme of manufacturing iron parts awaits only the methods of preparation of pure iron oxides at a reasonable cost.

There is another field of usefulness of finely divided iron oxide. In the ever widening search for petroleum many more and deeper wells must be drilled. This drilling of oil wells involves the use of drilling mud having an apparent density of from 9 to 12 or more lb. per gal. One of the faults of the earlier use of iron oxide for this purpose is that it hydrates readily and plugs up rock structures. However, this quality can be eliminated in several ways.

For another phase of industry this very quality of hydration and sticking to rock structures lends itself to good advantage. Cement blocks can be colored red, brown, yellow, blue-grey by appropriately prepared iron oxide. A mixture of such a material not only gives desirable color tints but also improves the water proofing qualities of the blocks. Stone surfaces painted in place with an iron oxide water mixture if let alone will never look the same as before. In some cases the effect is pleasing, in others quite the opposite; there is much room for good work here.

C. C. DeWitt, Michigan State College, before the regional meeting of the American Institute of Chemical Engineers, St. Louis, Mo., May 13, 1947.

Scientific Development of Catalytic Converters

Hit or miss development of optimum results in catalytic converters making industrial chemicals can be largely eliminated by a sound and fundamental knowledge of the kinetics of the various reactions involved in the process. If reliable rate equations are available which express the rate of each primary, secondary and side reaction in terms of the controlling variables, it is possible to explore the results of any proposed design or combination of operating conditions by

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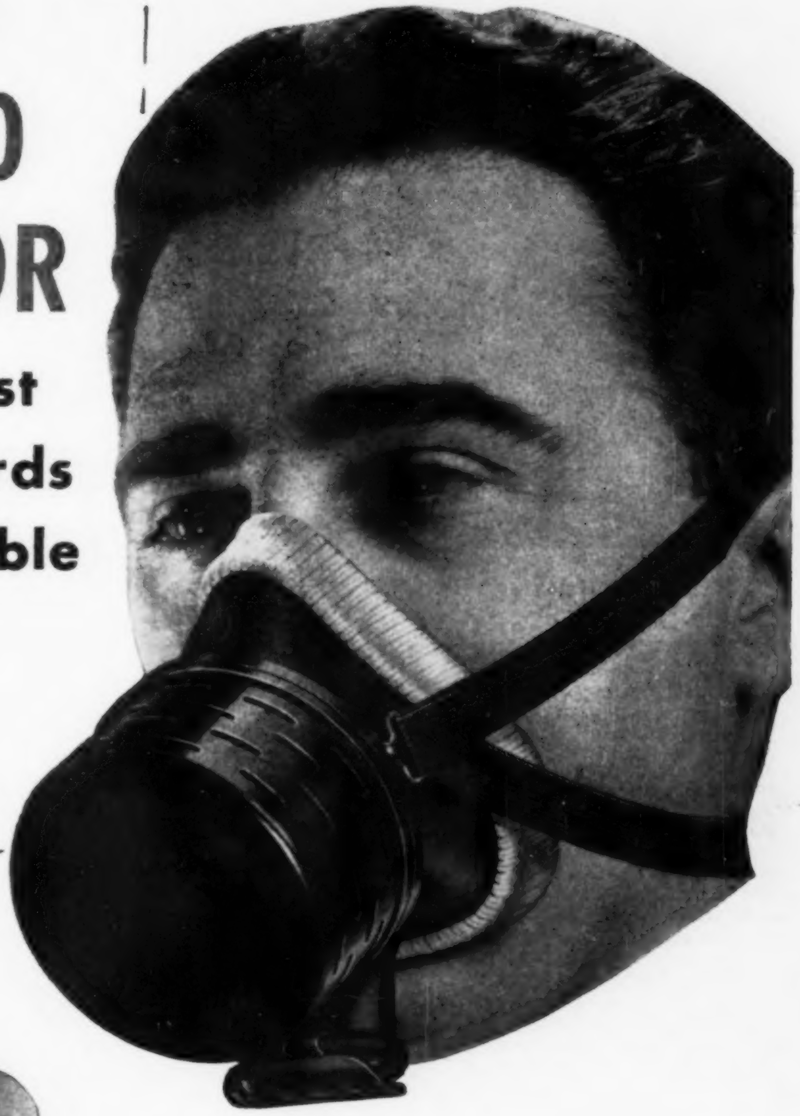
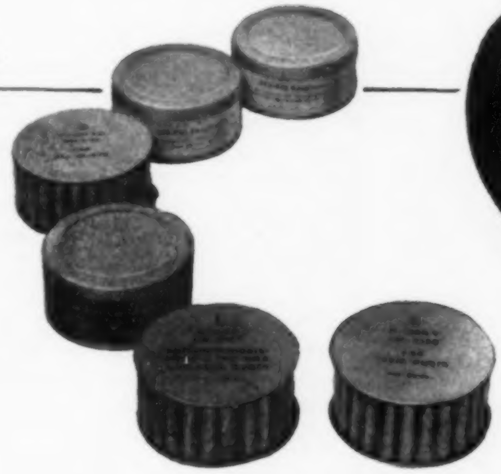
R-1000 RESPIRATOR

Protects Against Over 140 Hazards by 7 Interchangeable Cartridges





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mathematical analysis. In this manner precise optimum designs can be arrived at in days instead of months or years.

Systems which have been investigated by the Department of Chemical Engineering of the University of Wisconsin are the oxidation of sulphur dioxide, the dehydrogenation of butane to butenes, the dehydrogenation of butenes to butadiene, and the production of toluene by the interaction of benzene and xylenes.

K. M. Watson and L. H. Beckberger, University of Wisconsin, before the American Institute of Chemical Engineers, St. Louis, Mo., May 12, 1947.

The Equation of U 235 Fission

A CAREFUL study, both qualitative and quantitative, has been made of a large majority of U^{235}-fission products and this information has been recently issued by the Plutonium Project. Thus it is now possible to calculate the amounts of the elements formed and to complete the fission equation. It is as follows, if written in its elemental form:

$$100\,U^{235} + 100\,n'_s \rightarrow$$

$$\begin{array}{ll} \text{Light Elements} & \left\{ \begin{array}{l} 29.1\,Zr + 25.2\,Mo + 12.4\,Ru + \\ 6.2\,Tc + 6.1\,CB + 4.6\,Y + \\ 4.0\,Rb + 3.7\,Sr + 3.7\,Rh + \\ 3.05\,Kr + 1.52\,Pd + 0.23\,Ag + \\ 0.062\,Cd + 0.010\,In \end{array} \right. \\ \text{Heavy Elements} & \left\{ \begin{array}{l} + 22.2\,Nd + 19.7\,Ba + 13.0 \\ Xe + 12.5\,Ce + 11.0\,Cs + 6.5 \\ La + 6.2\,Pr + 2.7\,E61 + 2.15 \\ Te + 1.88\,Sm + 0.75\,Eu + 0.18 \\ I + 0.081\,Sn + 0.052\,Gd + \\ 0.031\,Sb \end{array} \right. \end{array}$$

$$+ 200 - 300\,n'_s + E$$

(This equation pertains of course to slow neutron fission, but in its essential features it should also apply to fast neutron fission.)

The four elements, Nd, Ba, Zr, and Mo, are the most abundant out of the 34 elements detected among fission products and these four alone account for about 50 weight percent of the uranium fissioned. The actual quantities per 100 grams U^{235} fissioned are: Nd, 13.7 g.; Ba, 11.5 g.; Zr, 11.5 g.; Mo, 10.5 g.

It is particularly interesting that elements 43 and 61, which do not occur naturally because their isotopes are radioactive, are produced in substantial amounts—namely 2.6 g. of technetium and about 4 g. of E61 with the atomic weight 147 per each 100 g. of U^{235} fissioned. Thus the Hanford piles (and also Bikini Atoll) have become rich artificial sources of these two elements.

The fission equation above describes the elemental composition of fission products as it will establish itself after the decay of short-lived products—for

instance, in a few months after an atomic explosion. Since some fission products have a long life the final composition will be different. By determining the ratio of some of these isotopes it is possible to ascertain the original time of a particular explosion. The atomic weights, particularly of some elements produced, will differ from their ordinary atomic weights.

Aristid V. Grosse, Houdry Laboratories, before Division of Physical and Inorganic Chemistry, American Chemical Society, Atlantic City, April 18, 1947.

Ultrasonic Investigation of Molecular Properties

SUCH fundamental properties of molecules as weight, volume, and compressibility have been investigated through ultrasonics for more than two dozen alcohols of varied structure. These properties were obtained from measurements of the velocity of one megacycle (far above the audible limit at 20 kilocycles) ultrasound in the liquids. The velocities were determined with high precision by means of a quartzcrystal interferometer.

This method for finding molecular weights gives (for the straight chain compounds) results of 2 percent accuracy, comparable with that of conventional procedures; it requires knowledge of the density and refractive index, as well as sound velocity. Its value has been demonstrated for liquid polymers also, which foreshadows possible usefulness in the plastics industry.

The volume occupied by a single molecule of each type was calculated by introducing sound velocity into the van der Waals equation for the behavior of non-ideal gases. Satisfactory agreement with previous results was observed.

Because of the large number of alcohols studied, interesting generalizations concerning compressibility were apparent. For example, the compressibility decreases in a predictable way as the carbon chain is lengthened, but increases as the chain becomes more highly branched. The values found are almost identical with those obtained more laboriously from mechanical pressure devices, in the few cases where the latter data are available.

Alfred Weissler, Navy Department Naval Research Laboratory, before the Physical and Inorganic Division, American Chemical Society, Atlantic City, April 17, 1947.

Training in Statistical Methods Needed

AMERICAN industry is suffering from an acute shortage of scientists and engineers trained in statistical

methods. Within a few years we can expect to see an industrial operations research group attached to the management of large industrial corporations, carrying out analyses of operations analogous to those done by a military operations research group for its command during the war. The function of such a group would be to analyze the performance of men, machines and processes under actual conditions of operation.

The greatest obstacle in the way of a wider introduction of the necessary modern statistical methods into industry is the lack of trained personnel and training facilities. Of the research personnel now in industry who are concerned with the application of statistical methods, virtually none received any statistical training in college, but have had to rely on short courses, reading and discussion.

This lack of training is due largely to the very rapid growth in the use of statistical methods in recent years. It is clear from the 20-year history of statistical quality control that it took a war to bring the movement to a stage resembling maturity.

It is unfortunate that the methods were not introduced into industry gradually over a longer period of time, so that there would have been an opportunity for the proper development of highly qualified personnel to put them into effect and to operate them accordingly.

To meet the immediate demand for statistically trained men in industry, until there is time to readjust educational programs, colleges and universities should take the initiative and arrange courses or conferences on various topics in industrial statistics for men of industry in their own localities.

Samuel S. Wilks, Princeton University, before the American Chemical Society, Atlantic City, April 15, 1947.

Composition of Strong Phosphoric Acids

Phosphoric acids having a P_2O_5 content from 72.4 to 88.8 percent have been analyzed in terms of their ortho, pyro, tri-, and metaphosphoric acid contents. Recently reported methods for the determination of pyro- and triphosphates have permitted a more accurate study of the composition of these acids. Curves are presented which show the composition of strong phosphoric acids of varying P_2O_5 content.

Orthophosphoric acid was found in all the mixtures and pyrophosphoric acid was present between 73 and 85 percent P_2O_5. Trisphosphoric acid,

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which has not previously been reported in strong phosphoric acids, was found in all the mixtures above 73 percent P_2O_5. Two metaphosphoric acids are proposed, one of which precipitates barium similar to the so-called "hexametaphosphate" and the other, which appears at slightly lower P_2O_5 concentrations, is believed to be a lower polymer, although no satisfactory methods were found for its identification or determination. The low polymer meta acid was present between 79 and 88 percent P_2O_5 and the high polymer above 82 percent P_2O_5. Mixtures containing between 79 and 80 percent P_2O_5 crystallized on standing and the solid phase was found to contain a higher percentage of pyrophosphoric acid than the liquid phase. No difference in composition was found between the acids prepared by dehydrating orthophosphoric acid by heat and those prepared by the addition of P_2O_5 to 85 percent orthophosphoric acid.

Evidence confirming the composition of the strong phosphoric acids was obtained by preparing the sodium salts from one of the acid mixtures. The sodium salts were identified by microchemical tests, refractive indexes, and melting points.

R. N. Bell, Victor Chemical Works, before Division of Physical and Inorganic Chemistry, American Chemical Society, Atlantic City, April 15, 1947.

FOREIGN LITERATURE ABSTRACTS

Sulphonating Action of Diethyl Sulphate

Reaction of diethyl sulphate with methyl diphenylamine, anisol, diphenyl ether and di-isoamyl ether was investigated. No addition product (quaternary ammonium compound) is formed in the reaction of diethyl sulphate with methyl diphenylamine. When the reaction is carried out at a temperature of 140-150 deg., the disulpho acid of methyl diphenylamine is formed in addition to the monosulphoacid. The reaction is accompanied by liberation of a certain amount of ethyl alcohol and diethyl ether. Anisol and diphenyl ether are sulphonated much less smoothly with diethyl sulphate than they are with dimethyl sulphate. The disulphonic acid of diphenyl ether is formed as well as the monosulphonic acid in the reaction with diphenyl ether. Ethyl alcohol and diethyl ether, together with gaseous products, are liberated in both cases,

which shows that thermic decomposition of the diethyl sulphate takes place together with sulphonation. Diethyl sulphate decomposes di-isoamyl ether at a somewhat higher temperature than dimethyl sulphate does and similar decomposition products are formed in both cases. Neutral dimethyl and diethyl sulphate sulphonate diphenyl ether in exactly the same manner as the usual (having acid reaction) preparations of these dialkyl sulphates.

Digest from "Sulphonating Action of Dialkyl Sulphates. III Reaction of Diethyl Sulphate with Methyl Diphenylamine and Certain Ethers" by V. N. Belov and M. Z. Finkelstein, *Zhurnal Obshchei Khimii* XVI, No. 8, 1248-1254, 1946. Published in Russia.

Styrene Manufacture

A METHOD for preparation of styrene by catalytic dehydrogenation of ethylbenzene was developed in the laboratory of the Institute of Organic Chemistry of the Academy of Sciences of the USSR even before the war. This method could be used with or without dilution with carbon dioxide or nitrogen. The maximum yield of styrene per ethyl benzene passed through was observed at 650 deg., with the space velocity of the ethylbenzene being approximately 400 g. per liter of catalyst per hour and a CO_2 dilution of 1:2 (mol.). Under these conditions the yield of styrene was 50-55 percent of the ethylbenzene passed through. A mixed copper-chromium catalyst was used, which is easily regenerated by burning out the carbon film with a current of air at 500-600 deg. Further work was carried out on the following questions: effect of space velocity on the yield of styrene at different temperatures, productivity of the catalyst, effect of the length of catalyst layer, balance data, regeneration of the catalyst, effect of reduced pressure, activation of the catalyst with hydrogen, inactivation with admixture of barium salts, possibility of obtaining a more active catalyst. More favorable conditions were found for conducting the reaction—a lower temperature (600 deg.), the possibility of working at higher space velocities on the order of 1000 ml./l./hr. of liquid ethylbenzene when the efficiency of the catalyst is higher. It was found that an increase in the length of the catalyst layer under given conditions has almost no effect on the yields of styrene and that the rate at which ethylbenzene is passed through, within a given range, has little effect on the yield. At 600 deg. space velocities of liquid ethylbenzene of 470-540 ml./l./hr. and CO_2 dilution of 1:2 mol, the yield of styrene was approximately 43 percent of the ethylbenzene passed through and 86 percent of the ethylbenzene decomposed. Reduction

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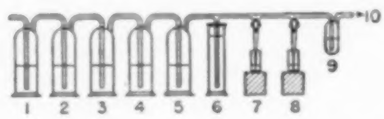
in the pressure has a favorable effect on the dehydrogenation of the ethylbenzene.

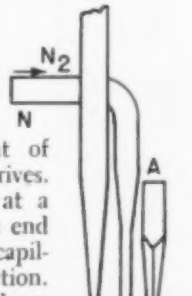
Digest from "Preparation of Styrene by Catalytic Dehydrogenation of Ethylbenzene. Report II" by A. A. Balandin and G. M. Marukyan, *Zhurnal Prikladnoi Khimii* XIX, No. 7, 623-631, 1946. (Published in Russia.)

Polarography of Oxygen-Free Solutions

ELECTROLYSIS was carried out in a vessel 2 cm. in diameter and 5 cm. high. The mercury serving as anode was at the bottom and was covered with about 4 cm. of the solution to be analyzed. The gas is bubbled through the solution of electrolyte in such an apparatus as the one shown in the attached illustration. Nos. 7 and 8 are



the vessels containing the electrolyte, 1 and 2 are the washing bottles containing alkaline pyrogallol, 5 contains water. In 6 a T-shaped tube leads to a cylinder serving as safety valve, while 9 is a bubble tube for determining the rate of flow through the lateral tube 10, which is connected by a rubber tube to tube N shown in the second attached illustration. In this manner, the gas (N_2, H_2 or CO_2) is completely freed of oxygen and in 5 minutes the latter is totally eliminated from the solution of electrolyte. After this, the container for electrolyte P is taken out and placed in a support. The attached illustration shows the arrangement used.



Through N the containers is connected with the lateral tube 10 of the first illustration through which the current of oxygen-free gas arrives. Tube N is bent at a right angle and its end is pointed into a capillary of 1 mm. section. Its level is 3 mm. above that of the electrolyte. The rate of flow should be such that no depression is produced on the surface of the liquid under the capillary. This rate is about 2 bubbles per second in 9. In the illustration K is the capillary of the cathode and A is the conductor tube for the mercury anode.

Digest from "Polarography in Oxygen-Free Solutions" by C. Hahn, *Dansk T. Farm.* 19, No. 2, 34-38, 1945; *Chimie et Industrie* 56, No. 3, 218, 1946. (Published in Russia.)

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

Practical Problems

The Application of Differential Equations to Chemical Engineering Problems. *By W. R. Marshall, Jr. and R. L. Pigford. Published by the University of Delaware, Newark, Del.* 170 *pages.* $3.50.

Reviewed by T. K. Sherwood

As its title suggests, this is a book on the application of ordinary and partial differential equations to various practical problems encountered in applied chemistry and in unit operations of chemical engineering. It includes chapters on Bessel functions, Fourier series, equations of finite differences, and operational calculus. An excellent series of problems is presented as part of the text, the majority being solved in detail. It does not treat graphical or numerical methods, precision of measurements, or partial differentiation.

The book is unquestionably an important and valuable contribution to the literature of chemical engineering from both the mathematical and chemical engineering viewpoint. It is somewhat more advanced than other books in the field, (for example, the one by C. E. Reed and the reviewer). It is probably not suitable as an undergraduate text even in those schools where a course in differential equations is required, but it will serve as a valuable text in graduate courses and as a reference for graduate students. The large page size is to be commended and the lithoprinting is well done. Those who will use the book will perhaps regret that it was not published in more permanent form with cloth instead of paper covers.

The trend in chemical engineering towards the use of more and more mathematics make this addition to the literature valuable and timely. Chemical engineers will generally find it much more helpful than standard texts on differential equations written by mathematicians, or even the texts on applied mathematics written by engineers other than chemical engineers. The illustrative problems present interesting chemical engineering material, and, in some cases, represent new contributions of real value. This technique of presenting mathematics through the medium of practical problems in the student's professional field is one of great educational power.

As might be expected, the problems are restricted for the most part to heat transfer, distillation, and absorption; although some are of perhaps little practical importance, they are generally well selected and of broad interest. The reviewer has no important criticism of the subject matter except perhaps to suggest that it would have been well to have included the Douglass generalization of the Bessel equation.

27 Syntheses

Organic Syntheses. *Vol. 26. Edited by Homer Adkins. John Wiley & Sons, New York. 124 pages.* $2.25.

Reviewed by C. J. Cavallito

Volume 26 contains in the usual style the description of 27 organic syntheses, including the preparation of an aliphatic and an aromatic anhydride allyl lactate, 3-amino-1,2,4,- triazole, benzylchloromethyl ketone, 2-bromopyridine, *n*-butyl acrylate, ethylene thiourea, 2-isopropylaminoethanol, julolidine, α-ketoglutaric acid, lepidine, methyl 5-bromovalerate, methylsuccinic acid, muconic acid, *p*-nitrophenylarsonic acid, 1,5-pentanediol, pyocyanine, terephthalic acid, *o*-tolualdehyde, and other compounds. Several of the syntheses are types which are of general applicability. There is also offered the preparation of *d*-glucosamine hydrochloride from the natural source, chitin. The apparatus and method of preparation of ozone is described in some detail. The preparation and properties of supported palladium catalysts is outlined.

This volume contains fewer than the usual number of organic syntheses included in previous volumes, however, the preparations of ozone and of palladium catalysts brings the volume up to the usual size. The descriptions of inorganic substances whose chief application is in organic reactions, are logically included in this series of references.

RECENT BOOKS RECEIVED

Buna Rubber, The Birth of an Industry. By F. A. Howard. Van Nostrand. $3.75.
The Chemistry and Technology of Plastics. By R. Nauth. Reinhold. $9.50.
A Century of Silver. By E. C. May. McBride. $3.50.
Essays in Rheology. Edited by the British Rheologists' Club. Pitman. $3.
Fundamentals of Plastics. Edited by H. M. Richardson. McGraw-Hill. $5.
Injection Molding of Plastics. By I. Thomas. Reinhold. $10.
Low-Pressure Laminating of Plastics. By J. S. Hicks. Reinhold. $4.50.
Matthews' Textile Fibers. 5th ed. Edited by H. R. Mauersberger. Wiley. $12.50.
Modern Plastics Encyclopedia. 11th ed. Plastics Catalogue Corp. $8.50
Six-Place Tables. 7th ed. By E. S. Allen. McGraw-Hill. $2.50.
Theory and Application of Radio-Frequency Heat. By G. H. Brown, C. N. Hoyler, and R. A. Bierwirth. Van Nostrand. $6.50.

Rare-Earth Chemistry

The Rare-Earth Elements and Their Compounds. *By D. M. Yost, H. Russell, Jr., and C. S. Garner. John Wiley & Sons, New York.* 92 *pages.* $2.50.

Reviewed by F. C. Nachod

Little information on rare-earth elements is found in concentrated form in most textbooks. Thus the monograph by Drs. Yost, Russell, and Garner is a valuable addition to the literature and will be welcomed by many.

The chapters comprise: Electronic structures and oxidation states of the rare-earth elements, paramagnetic properties, absorption spectra, evidence for the existence of element 61, separation of the rare earths, and chemical and physical properties. Three appendixes on nuclear properties, on general physical constants, and the periodic system of the elements, as well as indexes round out the book.

While in a critical review and compilation such as the present text, the selection of the material is left somewhat to the discretion of the authors, it is difficult to understand why the coverage of the subject matter is not more complete. For example, the paper by Russell and Pearce on the fractionation of rare earths by ion exchange (*J. Am. Chem. Soc.* **65** 595 (1943) should certainly at least have

been mentioned in chapter five which deals with separation methods.

Only few typographical errors are encountered, mostly where foreign literature is cited. Incidentally, the incorporation of literature references in the text instead of using footnotes makes for some "disjointedness."

The booklet probably is the best source of information on rare-earth chemistry and as such is recommended to teacher and research investigator alike.

Fundamentals

NUCLEAR PHYSICS TABLES AND AN INTRODUCTION TO NUCLEAR PHYSICS. *By J. Mattauch and S. Fluegge. Interscience Publishers, New York.* 191 pages. $12.

Reviewed by Walter DeCew

FUNDAMENTAL concepts of atomic nuclei and nuclear reactions are explained in the first half of this book in such a way, that chemical engineers with no previous training in nuclear physics can gain a sound intuitive picture of this otherwise intrinsically mathematical subject. The relation between nucleonic engineering and chemical engineering is brought out by the authors treatment: where atomic chemistry deals with the interactions and properties of the electron clouds surrounding the nuclei of different elements, nuclear chemistry deals with the interactions and properties of nuclear particles.

Extensive tables of nuclear reactions and properties of radioactive nuclei form what might be called the "Beilstein" of nuclear chemistry. This authoritative and by no means outdated text and reference book should be in the hands of all chemical engineers who are participating, or hope to participate in the development of the atomic energy industry.

Far From Superficial

MECHANISMS OF REACTIONS AT CARBON-CARBON DOUBLE BONDS. *By Charles C. Price. Published by Interscience Publishers, New York.* 120 pages. $2.50.

Reviewed by G. F. Kinney

A SERIES of lectures at the Polytechnic Institute of Brooklyn, representing a review and correlation of material appearing in the current literature, is presented here. Titles to the seven chapters are indicative of the nature, and are "Electronic Structures of Unsaturated Organic Molecules" (34 pages), "Ionic Reactions Involving Double Bonds" (17 pages), "Free Radical Reactions Involving Double Bonds" (18 pages), "Free Radical Ad-

dition Polymerization" (22 pages), "Copolymerization" (14 pages), "Emulsion and Suspension Polymerization" (6 pages), and "Polar Polymerization" (5 pages).

The subject matter is well presented, and is far from superficial in spite of the short space assigned to each topic. The chapter on electronic structure gives a clear picture of the simpler concepts of electrostatics that make unnecessary some of the less reasonable suggestions advanced by the proponents of "resonance" theory. Case histories of individual reactions form the bulk of the later chapters. Some one hundred references are included.

Comprehensive

TUNGSTEN. *Second Edition. By K. C. Li and Chung Yu Wang, Reinhold Publishing Corp., New York.* 430 pages. $8.50.

REVISED and enlarged, this second edition of "Tungsten," written by two outstanding authorities in the field, brings up-to-date the changes in chemical technology, metallurgy, applications and economics of this metal and its compounds that have taken place since the previous edition was published in 1943. Advances in technology made during the last war, especially those contributed by German scientists for the Nazi military machine, have been incorporated.

Most of the additional material in this present edition has been included in the chapter on geology, which gives details on all the known deposits of tungsten ores throughout the world, and the sections dealing with metallurgy, properties and applications of tungsten alloys, and economics. Detailed statistics on production and prices are included. The work is a comprehensive and valuable treatise on the subject and contains an extensive bibliography, including the patent literature.

BRIEFLY NOTED

Economic Research and the development of Economic Science and Public Policy. Published by the National Bureau of Economic Research, 1819 Broadway, New York 23, N. Y. 198 pages. Various aspects of the economics of science are dealt with by authorities in these 12 papers presented at the twenty-fifth anniversary meeting of the Bureau.

Incendiary Warfare. By George J. B. Fisher. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. 125 pages. $1.75. Although it is to be hoped that the theme of this book is untimely, it is the first authoritative text on the technique of producing fire with military projectiles, ground and

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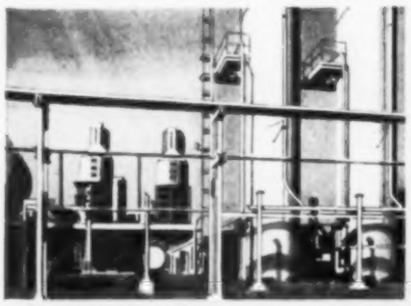

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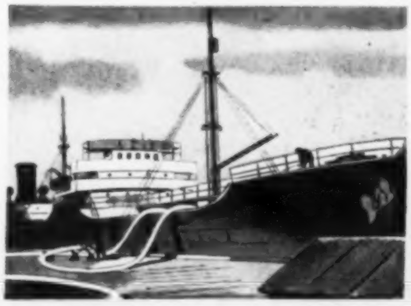

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air, and the tactics followed in aerial incendiary bombardment. The book traces the development of incendiary warfare from its inception.

International Contracts and the Anti-Trust Laws. By H. A. Toulmin, Jr. Published by The W. H. Anderson Co., Cincinnati, Ohio. 1,068 pages. $15. In the belief that healthy business relationships between peoples of different countries play a vital role in the development of permanent international peace, Mr. Toulmin has gathered into this book the factors that must be taken into account in insuring a sound basis for private international commerce. He provides an analysis of the policy and statutes of the United States in relation to the rights, privileges and dangers of American private interests engaged in foreign trade control through international agreements.

Organic Analytical Reagents. By Frank J. Welcher. Published by the D. Van Nostrand Co., 250 Fourth Ave., New York, N. Y. 442 pages. $8. Here, assembled in one place, are descriptions of all organic compounds used in the analysis of inorganic substances and discussions of the methods employing these reagents. Each compound is treated completely in one section for the convenience of localized information. References to the literature, which include all articles appearing in *Chemical Abstracts* up to and including 1945, indicate the subject matter of each.

Essays in Rheology. Pitman Publishing Corp., New York. 102 pages. $3. Published under the general editorship of a committee of the British Rheologist's Club, this little book is a contribution to the literature of a new science—the study of the deformation and flow of matter. Based on a conference at Oxford, it contains six chapters which cover rheology of metals, polymers, and liquids; relationship between compression and shear tests; nomenclature; and applications in medicine, naval problems and in the fine arts.

Physical Constants of Hydrocarbons. Vols. III and IV. By Gustav Egloff. Published by Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. 661 and 540 pages. $15 and $17.50. Volume III of ACS Monograph 78 continues Dr. Egloff's series by giving available data on benzene and its derivatives, biphenyl and derivatives, and other mononuclear aromatic hydrocarbons. Volume IV is a continuation of III. It collates and evaluates physical constants of polynuclear aromatics—fused ring hydrocarbons with at least one aromatic ring.

Scientific Progress in the Field of Rubber and Synthetic Elastomers. Edited by H. Mark and G. S. Whitby. Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. 453 pages. $7. Inaugurated by the late Elmer O. Kraemer, this book is Vol. II in the series "Advances in Colloid Science." It contains nine divisions in which various authors, chosen for their specialized knowledge of their subjects, develop specific facets of recent work in the field of natural and synthetic rubbers.


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carcass...so important to tire li
● New adhesives are replacing
riveting and other old methods
ing in many industries. Many
makers save time and money
bling with Flintkote Industrial
● Flintkote Binder Compounds
ing many fabricators speed up th
tion. Among the uses of such co
are curled hair (above) and glass

RECENT BOOKS and PAMPHLETS

Caustic Potash. Chemical Safety Data Sheet SD-10, published by the Manufacturing Chemists' Association, 608 Woodward Bldg., Washington 5, D. C. 11 pages. 20 cents. Tenth in a series of manuals presenting essential information for the safe handling and use of chemical products.

Manual on Collective Bargaining for Professional Employees. Prepared by Waldo E. Fisher. Published by The Committee on the Economic Status of the Engineer. 64 pages. $1. Offers professional employees information pertaining to collective bargaining under the National Labor Relations Act and examines certain proposals for modifying the Act.

Handbook of Uranium Minerals. By Jack DeMent and H. C. Dake. The Mineralogist Publishing Co., 329 Southeast Thirty-second Ave., Portland 15, Ore. 80 pages. $1.50. Catalog of the uranium and thorium minerals including methods for their detection, location and exploration.

American Safety Standards. Published by American Standards Association, 70 East 45th St., New York 17, N. Y. 19 pages. A listing and brief description of about two hundred standards covering safety and industrial health.

A New Notation and Enumeration System for Organic Compounds. By Malcolm Dyson. Published by Longmans, Green and Co., 55 Fifth Ave., New York 3, N. Y. 63 pages. $1.75. Explanation of new system of delineation as it applies to organic compounds.

Cumulative Catalog of Library of Congress Printed Cards, January, 1947. Published by The Library of Congress, Washington 25, D. C. 71 pages. The first issue of a monthly bulletin which will reproduce the catalog cards currently printed by the Library of Congress.

Xylene Technical Review. Published by the Oronite Chemical Co., 30 Rockefeller Plaza, New York 20, N. Y. 32 pages. A review of the available references on the three isomeric xylenes, including a bibliography.

Analytica Chimica Acta. Edited by Paul-E. Wenger. Elsevier Publishing Co., 215 Fourth Ave., New York 3, N. Y. 72 pages. $9.50 per year. The first issue of a monthly journal dealing with analytical chemistry.

Properties of Limerock Concrete. By Mack Tyner. Reprinted from the Quarterly Journal of The Florida Academy of Sciences, Vol. 8, No. 4, 22 pages. A technical paper of the Florida Engineering and Industrial Experiment Station containing graphs, tables and photographs.

Who's Who in Labor. Edited by Marion Dickerman and Ruth Taylor. Published by the Dryden Press, 386 Fourth Ave., New York 16, N. Y. $12. A current guide to the important figures in the unions.

Tentative Specifications for Corrosion Resisting Chromium and Chromium-Nickel Steel Welding Electrodes. Published jointly by the American Welding Society, 33 West 39th St., New York 18, N. Y. and the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 13 pages. Tentative specifications and guide to the A.W.S.-A.S.T.M. classification of welding electrodes. Available from the Arcos Corp., 360 Gulf Building, Philadephia 2, Pa.

America's Stake in World Trade. By Gloria Waldron and Norman S. Buchanan. Pamphlet No. 130, published by the Public Affairs Committee, 22 East 38th St., New York 16, N. Y. 32 pages. 20 cents. The first public announcement of the findings in Rebuilding the World Economy: America's Role in Foreign Trade and Investment, a new survey made by the Twentieth Century Fund.

Tables of Spherical Bessel Functions. Prepared by Mathematical Tables Project, National Bureau of Standards. Published by Columbia University Press,

Morningside Heights, New York. 375 pages. $7.50.

A.S.T.M. Standards on Glass and Glass Products. Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 86 pages. $1.25. First edition, includes definitions, test methods and specifications.

Pulpwood Stands, Procurement, and Utilization. TAPPI Monograph Series No. 4, published by Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York. 190 pages. Papers presented at the Detroit meeting of TAPPI last September.

Georgia Opportunities for the Manufacture of More Paper. By J. B. Hosmer. Special Report No. 24, published by State Engineering Experiment Station, Georgia School of Technology, Atlanta. 23 pages. 75 cents. Georgia opportunities and pulp and paper industries in the South.

Bibliography of Pulp and Paper Manufacture, 1936-1945. Compiled by C. J. West. Published by Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York. 1,153 pages. Consolidation of bibliographies 1936 through 1944 together with references to articles which appeared in 1945.

Practical Physiological Chemistry. Twelfth edition. By P. B. Hawk, B. L. Oser and W. H. Summerson. Published by the Blakiston Co., Philadelphia. 1,323 pages. $10. Chemical and physiochemical principles and methods applied to the study of living matter.

Process, Hazards and Protection Involved in the Manufacture of Spirituous Liquors. NBFU Research Report No. 5, published by National Board of Fire Underwriters, 85 John St., New York 7, N. Y. 60 pages. Describes how spirituous liquors are made and the attendant fire hazards and suggests to those in the liquor industry how to minimize and safeguard those fire hazards.

Welding Symbols. By Vincent C. Gourley. The Bruce Publishing Co., 540 North Milwaukee St., Milwaukee 1, Wis. 115 pages. $2.50. Drawings and explanations of welding standards and symbols recognized by the American Welding Society.

Directory of Tennessee Industries. Published by the Tennesee State Planning Commission, 432 Sixth Avenue North, Nashville, Tenn. 173 pages. $1. Listing of Tennessee concerns by city in which each is located, by classification of products, and an alphabetical index of all companies.

Forum on Diesel Fuel Oils. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 38 pages. $1. Eight non-technical papers on diesel fuel problems.

Operation of the Illinois State Geological Survey. By M. M. Leighton. Circular No. 126, published by the Illinois State Geological Survey, Urbana, Ill. 49 pages. A modern state geological survey which aids in revealing the secrets of the earth needed by industry.

Southern California Mines. Published by Board of Supervisors of Los Angeles County. Available from the Domestic Trade Dept. of Los Angeles Chamber of Commerce, Los Angeles. 26 pages. Contains a summary of metals and industrial minerals produced from Southern California mines in 1945, together with a description of operations at each producing mine.

Geology of the San Juan Bautista Quadrangle, California. By John Eliot Allen. Published by California Department of Natural Resources, Division of Mines, Ferry Bldg., San Francisco 11, Calif. Bulletin 133. 112 pages. Stratigraphy, structure, geomorphology, paleogeography and mineral resources in this area are discussed. Three 18 x 14-in. economic mineral geologic and structural section maps are included.

Geology of the St. Helens Quadrangle, Ore. By W. D. Wilkinson, W. D. Lowry and E. M. Baldwin. Bulletin 31. Published by the State of Oregon Department of Geology and Mineral Industries, 702 Woodlark Bldg., Portland 5. 39 pages. 45 cents. A study of the stratigraphy, geologic history and economic geology of this area. Included are eight photographs, maps and drawings, an index map and a geologic map.

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

Operations of Consumers' Cooperatives in 1945. Bureau of Labor Statistics, Bulletin 890. Price 10 cents.

Insecticidal Treatments for the Control of the European Corn Borer. By W. A. Baker and W. G. Bradley. Bureau of Entomology and Plant Quarantine, E-718. Processed.

Nicotine Insecticides. Part III—Dust Carriers for Nicotine. By E. L. Mayer, et al. Bureau of Entomology and Plant Quarantine, E-720. Processed.

A Digest of Information on Hexaethyl Tetraphosphate. By R. C. Roark. Bureau of Entomology and Plant Quarantine, E-721. Processed.

When Drought Returns to the Great Plains. By Tom Dale. Department of Agriculture, Farmers' Bulletin 1982. Price 5 cents.

Marketing Margins and Costs for Livestock and Meat. By Knute Bjorka. Department of Agriculture, Technical Bulletin No. 932. Price 25 cents.

Federal and State Standards for the Composition of Milk Products. Bureau of Dairy Industry, BDIM-Inf-45. Processed.

Peanuts—Stocks and Processing. September 1945-August 1946 season. Bureau of Agricultural Economics. Unnumbered, mimeographed.

Studies of Relations of Rainfall and Run-Off in the United States. By W. G. Hoyt and others. Geological Survey Water-Supply Paper 772. Price 60 cents. Report of actual conditions throughout the country, with interpretation of relationship to water supply and stream flow for power. A reprint.

Special Studies of Reservoir Oils in Naval Petroleum Reserve No. 1, Elk Hills Field, California. By Alton B. Cook and G. B. Shea. Bureau of Mines, Report of Investigations R. I. 4054. Mimeographed.

Apparatus for Determining the Reactivity of Calcium Carbide and Acetylene-Water Vapor Mixtures. By G. W. Jones, et al. Bureau of Mines, Report of Investigations R. I. 4067. Mimeographed.

Natural-Gasoline and Cycle Plants in the United States, January 1, 1946. Bureau of Mines, Information Circular I. C. 7399. Mimeographed.

Diesel Equipment in Underground Mining. By D. Harrington and J. H. East, Jr. Bureau of Mines, Information Circular I. C. 7406. Mimeographed. Safety factors in gas exhaust considered.

Fluorite and Zinc on the J. J. Shelby and H. McGuire Properties, Pope County, Illinois. By O. M. Bishop. Bureau of Mines, Report of Investigations R. I. 4048. Mimeographed.

Fluorite in the Mineral Ridge-Clay Lick Fault System, Livingston County, Kentucky. By Neal M. Muir. Bureau of Mines, Report of Investigations R. I. 4049. Mimeographed.

Huckleberry Spar Mine, Catron County,

New Mexico. By Forest J. Sur. Bureau of Mines, Report of Investigations R. I. 4053. Mimeographed.

Corundum Hill Mine, Macon County, North Carolina. By T. J. Ballard. Bureau of Mines, Report of Investigations R. I. 4042. Mimeographed.

Buck Creek Corundum, Clay County, North Carolina. By T. J. Ballard. Bureau of Mines, Report of Investigations R. I. 4052. Mimeographed.

Central Texas (Llano) Iron Deposits, Llano and Mason Counties, Texas. By A. M. Evans. Bureau of Mines, Report of Investigations R. I. 4045. Mimeographed.

Iron Deposits of Buckhorn Mountain, Meyers Creek Mining District, Okanogan County, Washington. By S. W. Zoldok, et al. Bureau of Mines, Report of Investigations R. I. 4051. Mimeographed.

Coughlin and Galena Level Zinc Mines Area, Lafayette County, Wisconsin. By M. Howard Berliner. Bureau of Mines, Report of Investigations R. I. 4047. Mimeographed.

Investigation of Coal Deposits in the Coal Creek District, Gunnison County, Colorado. Progress Report 1. By Albert L. Toenges, et al. Bureau of Mines, Report of Investigations R. I. 4104. Mimeographed.

United States Imports in 1946 of Products on Which the United States Will Consider Tariff Concessions in Current Trade Agreement Negotiations. U. S. Tariff Commission. Unnumbered, mimeographed.

Temperature Distribution in a Test Bungalow with Various Heating Devices. By Richard S. Dill and Paul R. Achenbach. National Bureau of Standards, Building Materials and Structures Report BMS108. Price 10 cents.

Iron Mountain Tungsten Deposits, Sierra County, New Mexico. By Walter R. Storms. Bureau of Mines, Report of Investigations R. I. 4035. Mimeographed.

Iron Mountain Beryllium Deposits, Sierra and Socorro Counties, New Mexico. By Walter R. Storms. Bureau of Mines, Report of Investigations R. I. 4024. Mimeographed.

Diamond Drilling and Diamond Bit Investigation. Part 1.—Drilling Tests in Uniform Granite. By Leonard Obert, et al. Bureau of Mines, Report of Investigations R. I. 4041. Mimeographed.

Tests of Instruments for the Determination, Indication, or Recording of the Specific Gravities of Gases. By Francis A. Smith, et al. National Bureau of Standards, Miscellaneous Publication M177. Price $1.

Electric Batteries and Standard Cells. National Bureau of Standards, Letter Circular LC846. Mimeographed. Publications by Bureau staff and references to other sources of information.

Report on Malayan and British Borneo Rubber Industry. Commerce Department. Price 25 cents.

U. S. Navy Structural Fire Fighting. Chief of Naval Operations Office. Price $1.25. Cloth.

Report of the Administrator of Agricultural Research, 1946. Includes the reports of the several technical bureaus which form Agricultural Research Administration. Price 50 cents.

Agricultural Statistics, 1946. Price $1.25.

Cotton Quality Statistics, United States, 1945-46. Department of Agriculture, Production and Marketing Administration. Processed.

Partial Purification and Properties of Tomatin, an Antibiotic Agent from the Tomato Plant. By Thomas D. Fontaine, et al. Bureau of Agricultural and Industrial Chemistry, AIC-138. Mimeographed.

Selected Publications of the Naval Stores Research Division on Production, Properties, and Uses of Naval Stores (Turpentine, rosin, pine gum, etc.) Bureau of Agricultural and Industrial Chemistry, AIC-144. Mimeographed.

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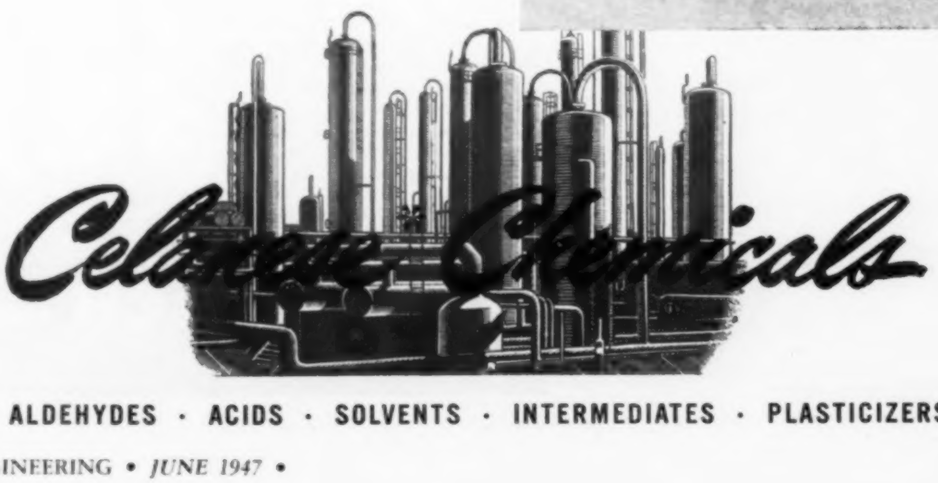
METHYLAL CONTENT	100%	95% Min.
COLOR	Water White	Water White
SPECIFIC GRAVITY $\frac{20°C.}{4}$	0.8601	0.8600—0.8630
FLASH POINT, OPEN CUP, approx.	0° F.	0° F.
BOILING POINT	42.3° C.	41.5°—43.5° C.
REFRACTIVE INDEX, $n\frac{20° C.}{D}$	1.3534	1.3530—1.3550

Write for sample and New Product Bulletin N-08-1.



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MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Readers' Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 153-154.

(*Continued from page 154*)

dustry. Contains a section on the fabrication of this metal and its corrosion resistance to various chemicals.

112. Pressure Reducing Valves. A. W. Cash Valve Mfg. Corp., Decatur, Ill.—4-page bulletin No. 199 illustrates and describes the pressure reducing valves made by this company. Principle of operation is described and the features of construction are shown in diagrammatic sketches.

113. Instruments. The Hays Corp., Michigan City, Ind.—Bulletin 47-800. 20-page catalog featuring the Hays-Cochrane electric type flow meters made by this company—details of construction and installation are shown pictorially, and the important features are discussed. Contains a section on liquid level controls, pressure and temperature recorders, and this company's area meter.

114. Strainers. Elliott Co., Jeannette, Pa.—Bulletin A-12 describes the Type K self-cleaning strainers which are recommended for service where a large amount of dirt or foreign matter must be removed from water. The strainers contain a rotating element operated by a motor. Construction features and operating principles are described, and the strainer is illustrated in detail.

115. Organic Chemicals. Rohm & Haas Co., Philadelphia, Pa.—Several technical bulletins are now available covering the properties and reactions of various amines, esters, chlorides and alcohols. Structural formulas are included.

116. Centrifugal Sand Pumps. Denver Equipment Co., Denver, Colo.—Bulletin P9-B4 is a four-page leaflet featuring the type SRL pump for handling abrasive slurrys. Construction details are shown in a diagrammatic sketch and capacities are tabulated. Contains a table of specific gravities which can be handled at various pump capacities. Bulletin P11-B2 is a one-page leaflet featuring the Wilfley centrifugal sand pump available from this company.

117. Process Equipment. John Nooter Boiler Works Co., St. Louis, Mo.—16-page booklet illustrating and describing the various types of fabricated process equipment made by this company. It is well illustrated with pictures of various pieces of equipment made from different corrosion-resistant metals and alloys. Contains a four-page section in which corrosion data are tabulated.

118. Pumps. Warren Steam Pump Co. Inc., Warren, Mass.—Bulletin 227 is a 6-page folder illustrating and describing the type DM and DL single-stage double-suction centrifugal pumps made by this company. Detail specifications are given and the capacity ratings and pump dimensions are tabulated. Sectional views show the features of construction. Bulletin 236 contains four pages featuring the type DBH centrifugal pumps made by this company. Contains specifications and rating tables.

119. Filters. Ertel Engineering Corp., Kingston, N. Y.—Catalog 15 is a 20-page bulletin featuring the filters and other liquid handling equipment made by this company. Filter presses which are par-

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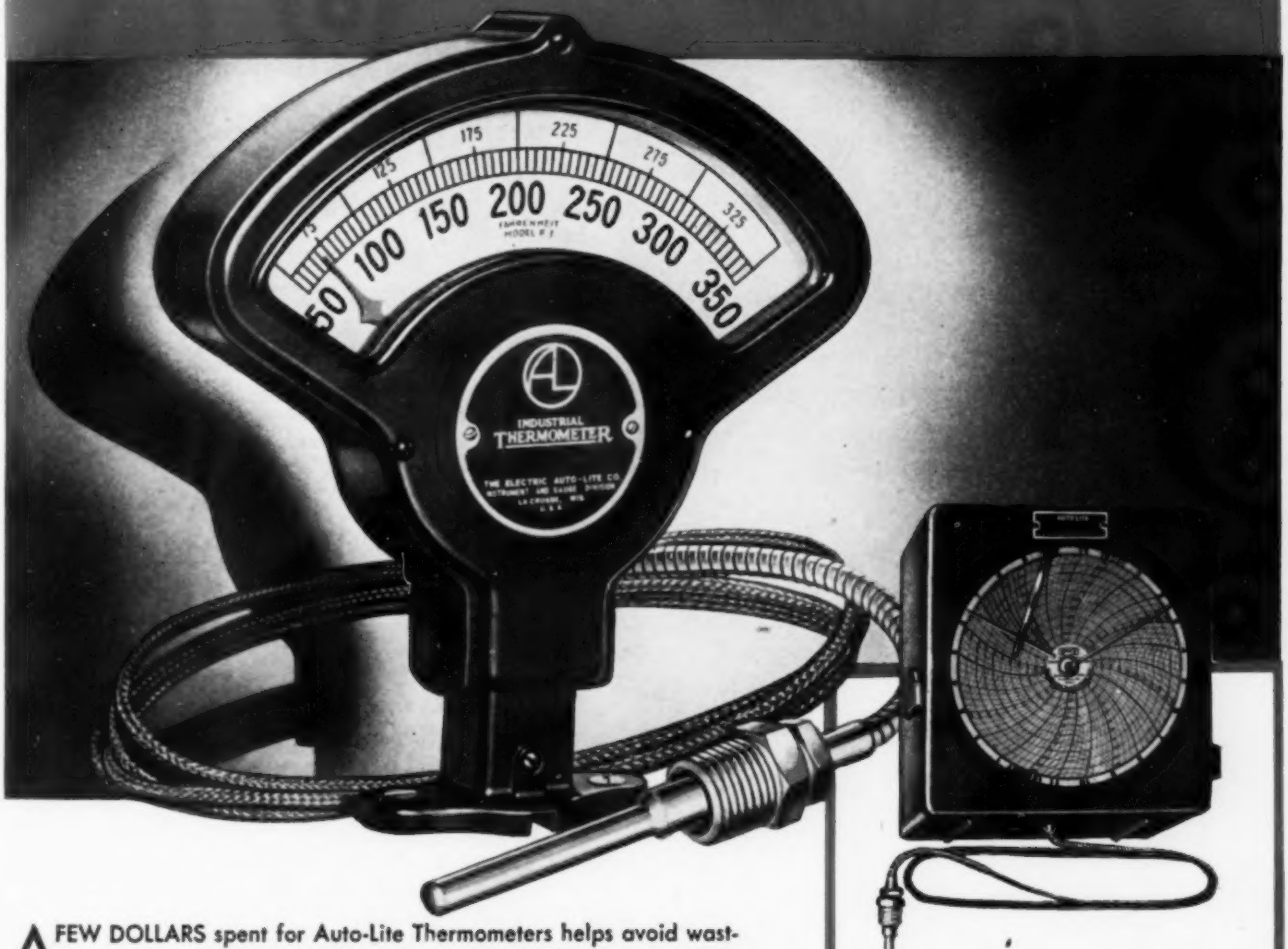

A FEW DOLLARS spent for Auto-Lite Thermometers helps avoid wasting many dollars in excessive power costs. The Auto-Lite Indicating Thermometer F-1, above, reliably reports temperature performance in processing and storage operations. It aids in maintaining uniform production and avoiding spoilage of materials. Supplied with capillary tubing, this thermometer may be mounted at some distance from the temperature source for convenient and systematic observation.

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ticularly useful for chemicals and pharmaceuticals are illustrated and described.

120. Control Valves. Fisher Governor Co., Marshalltown, Ia.—Bulletin A-100 contains eight pages illustrating and describing the Micro-Flute and Micro-Form Pup (proportional uniform percentage) inner valves which have equal percentage characteristics. Include flow curves. Also bulletin D-2 which contains eight pages featuring the series 4101 snap-acting Wizard pilot-operated pressure controllers made by this company.

121. Magnetic Clutches. Stearns Magnetic Mfg. Co., Milwaukee, Wis.—20-page catalog No. 226 illustrates and describes the magnetic clutches and clutch-brake unit made by this company. Contains specifications, illustrations, torque formulas and other information on magnetic friction device control.

122. Crushers. Grundler Crusher and Pulverizer Co., St. Louis, Mo.—Bulletin 242. 2-page leaflet featuring this company's pulverizers for use in the chemical process industries.

123. Process Engineering. S. D. Hicks and Sons Co., Hyde Park, Mass.—8-page booklet featuring the services offered by this company. Contains descriptions and illustrations of various types of equipment. Several process flowsheets show the types of processes designed and engineerd by this firm.

124. Process Equipment. Sante Fe Tank and Tower Co., Vernon, Calif.—Bulletin CE-47, contains information on the cooling equipment made by this company. Includes information on cooling towers, fin units, spray ponds, nozzles, etc.

125. Screens. Wedge-Bar Screen Corp., New York, N. Y.—8-page booklet describing the screens made by this company. Details of construction are illustrated and described, and assembly details are shown in diagrammatic sketches.

126. Rotary Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W-484-B1. 8-page booklet describing the general service type GA rotary pumps made by this company. Contains specifications, illustrations, dimension tables, and other useful information. Also Bulletin W-487-B10B features the heavy-duty rotary pumps made by this company. Includes performance curves, dimension tables, and detailed sectional views.

127. Economic Planning. Charles H. Welling & Co. Inc., New York, N. Y.—6-page pocket size folder describing the management services offered by this company.

128. Fire Protection. American LaFrance-Foamite Corp., Elmira, N. Y.—24-page booklet featuring the fire-protection equipment manufactured by this company.

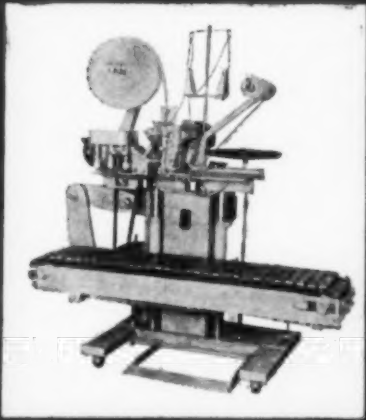
129. Instruments. Leslie Co., Lyndhurst, N. J.—Bulletin 462. 20-page illustrated booklet covering the external pilot-operated pressure controllers made by this company. Cross-sectional diagrams show the features of construction, and selection charts, as well as capacity tables are provided to guide the selection of equipment for specific applications. Also installation, operation, and maintenance instructions are included.

130. Pharmaceutical Equipment. F. J. Stokes Machine Co., Philadelphia, Pa.—Catalog 480-T. 28-page booklet illustrating and describing the equipment made by this company for use in the pharmaceutical industry.

131. Electric Motors. Reliance Electric & Engineering Co., Cleveland, Ohio—Bulletin C-118 and Bulletin C-125 illustrates and describe induction motors made by this company.

132. Jet Pumps. Derbyshire Machine & Tool Co., Philadelphia, Pa.—Catalog 315. 4-page leaflet illustrates and describes this company's jet pumps for utilizing water under pressure as the pumping medium used in the removal, transfer or mixing of liquids, sludges, process waste, and fluids containing substances injurious to conventional pumping equipment. Includes charts and tables to aid in the selection of these pumps.

133. Kettles. Lee Metal Products Co.



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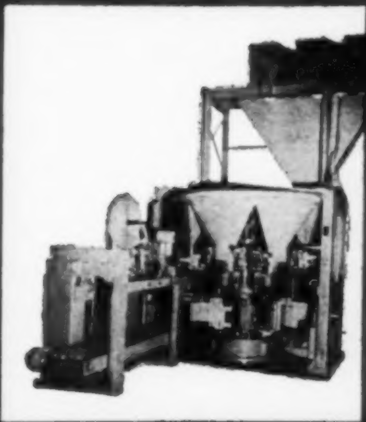

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Inc., Phillipsburg, Pa.—8-page bulletin describing the corrosion-resistant kettles made by this company. Different models of jacketed kettles are shown together with their specifications. Also includes data on the quick acting plug valves for use on these kettles.

134. Asbestos Textiles. Asbestos Textile Institute, Philadelphia, Pa.—32-page booklet entitled "A Primer on Asbestos Textiles" describes the history, characteristics, and broad range of uses and applications of asbestos textiles in industry.

135. Steel Plates. Joseph T. Ryerson & Son, Inc., Chicago, Ill.—8-page illustrated bulletin describing the high manganese, high sulphur analysis steel plates available from this company.

136. Adhesives. Paisley Products, Inc., Chicago, Ill.—4-page folder describing the Lignotite brand of casein glue for wood-joining operations. Contains information on the preparation and application of this product.

137. Stainless Steel Tubing. Babcock & Wilcox Tube Co., New York, N. Y.—Bulletin TB-323 describes some of the important properties of B&W Stainless Tubing . A number of applications are outlined. Also available is a revised version of the conversion table which converts inches and fractions of inches to decimal parts of a foot. Technical Data Card No. 110-A

138. Bonderizing. Parker Rust-Proof Co., Detroit, Mich.—4-page illustrated catalog describing the bonderizing process and its various applications.

139. Welding. Ampco Metal Co., Milwaukee, Wis.—Bulletins D-2325 and D-2326. Mimeographed sheets discussing the welding procedure for welding dies. Contains a list of recommended electrodes, polarity and current, amperage and voltage, preparation of materials and other information.

140. Chemicals. Edwal Laboratories, Inc., Chicago, Ill.—Booklet describing the characteristics and uses of phenyl mercuric compounds as germicides and fungicides.

141. Cleaning Chemicals. Pennsylvania Salt Mfg. Co., Philadelphia, Pa.—4-page leaflet describing MC-1, a general purpose cleaner for a wide variety of household and industrial uses.

142. Stainless-Clad Steel. Lukens Steel Co., Coatesville, Pa.—Bulletin 338 contains 16 pages illustrating and describing the stainless-clad steels made by this company. Characteristics and properties of clad steels are discussed, and the different types of formed heads are illustrated. Several pages are devoted to tabulating the resistance of stainless steel to corrosion due to various types of chemicals.

143. Laboratory Equipment. A. B. Stanley Co., Boston, Mass.—8-page folder featuring laboratory desks, hoods, and cabinets made by this company.

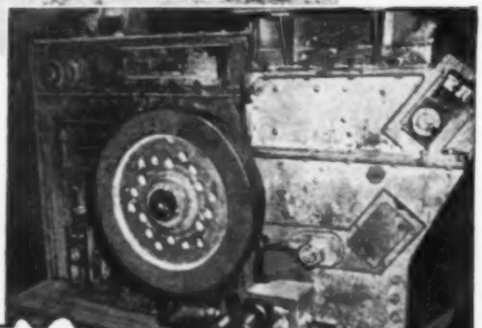
144. Water Treating. Liquid Conditioning Corp., New York, N. Y.—Bulletin 6 is a 2-page leaflet illustrating and describing the removal of iron, as well as iron and manganese from water. Bulletin 7 contains four pages featuring the removal of silica from water.

145. Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W-441-B10 illustrates and describes horizontal duplex power pumps for volatile liquids. Features, specifications, as well as sizes and ratings are described, while details of the pump are illustrated in diagrammatic sketches. Bulletin W-2-B30A features the Types KLF-KMF horizontal duplex power pumps for general high pressure service in oil fields and oil refineries.

146. Optical Instruments. Farrand Optical Co., Inc., New York, N. Y.—12-page bulletin No. 801 describes ultraviolet monochromators for research and laboratory use.

147. Protective Coatings. Prufcoat Laboratories, Inc., Cambridge, Mass.—4-page folder featuring the various types of Prufcoat protective coatings made by this company. Various types of applications are illustrated. Contains detailed directions for application.

148. Chemical Gases. Matheson Co., Inc., East Rutherford, N. J.—6-page bulletin



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listing practically all chemical gases now being manufactured and sold in this country. Contains pressures, purities and sizes of cylinders in which gases may be obtained. Illustrates various types of reducing valves, controls and regulators available from this company. Price list included.

149. Process Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 25-B6183, contains 12 pages illustrating and describing V-belts and drives, centrifugal pumps, motors, controls for use in heating, ventilating and air conditioning.

150. Labels. Ever-Ready Label Corp., New York, N. Y.—Catalog describing the various types of labels available from this company.

151. Instruments. Fischer & Porter Co., Hatboro, Pa.—Catalog Section 91-B is a 2-page leaflet featuring the continuous specific gravity testers made by this company.

152. Refractories. Illinois Clay Products Co., Joliet, Ill. 4-page folder describing the fire-clay products and other refractories made by this company. Also covers high temperature insulation.

153. Thermostat. Fenwal Inc., Ashland, Mass.—Catalog illustrates and describes the Thermoswitch thermostat made by this company. It includes a price list.

154. Plastics. Durez Plastics and Chemicals, Inc., North Tonawanda, N. Y.—8-page illustrated booklet showing a wide variety of objects made from Durez plastics. A number of unusual applications for these plastics are illustrated.

155. Steam Generators. Preferred Utilities Mfg. Corp., New York, N. Y.—Bulletin No. 1000-E is an 8-page illustrated booklet describing the unit steam generators made by this company. Outstanding features are described for different applications of different types of fuel oil. Contains a table of dimensions for different sizes of units.

156. Corrosion Tests. International Nickel Co. Inc., New York, N. Y.—8-page illustrated booklet entitled "Handling Caustics Without Corrosion Problems" contains test data on Monel, 70-30 copper-nickel, mild steel and other materials in refinery equipment handling caustic solutions.

157. Adhesives. Casein Co. of America, Div. of the Borden Co., New York, N. Y.—4-page leaflet featuring the application of this company's adhesives in the manufacture of pre-fabricated buildings.

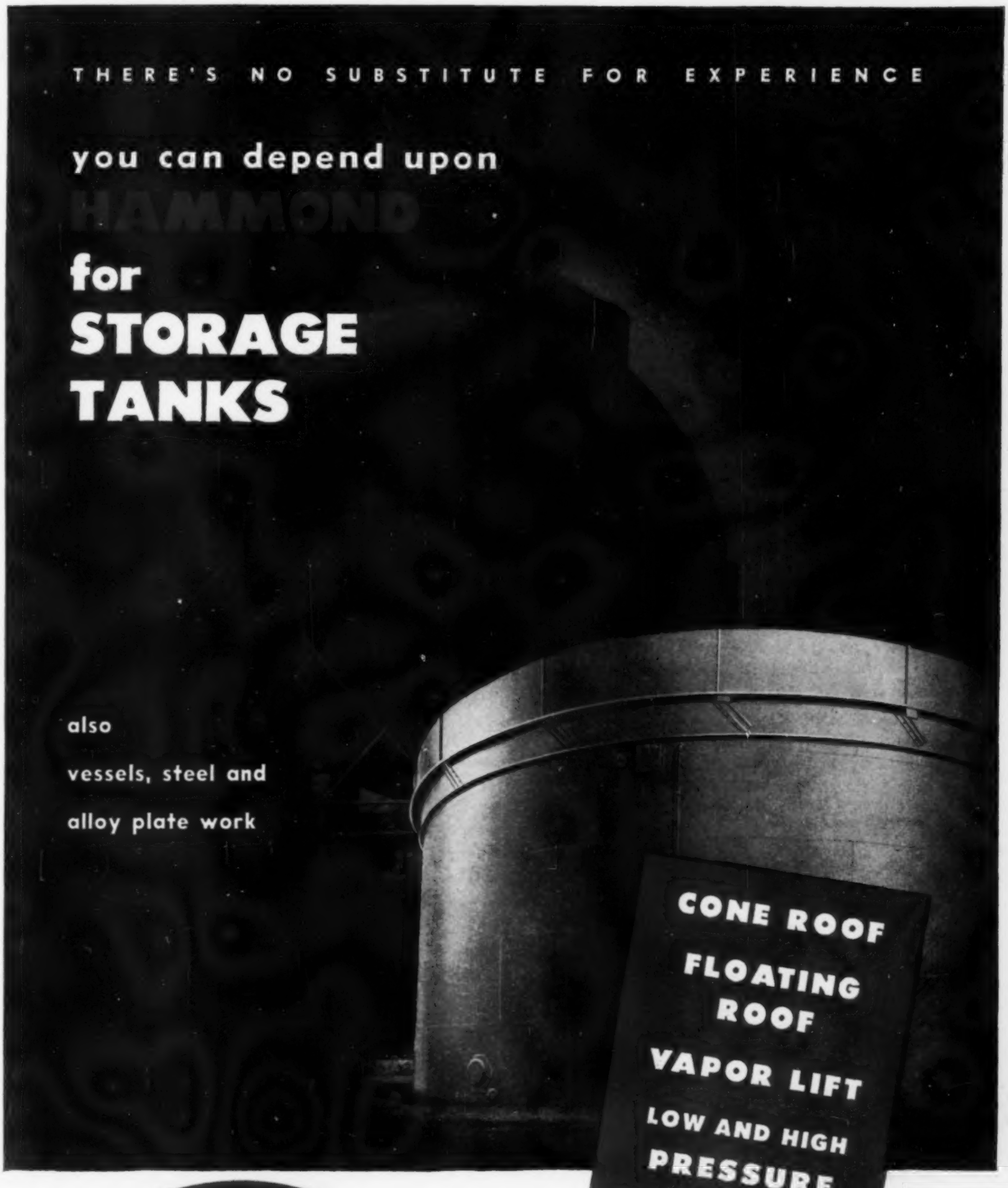
158. Instruments. Northern Equipment Co., Erie, Pa.—8-page bulletin No. 467 features this company's boiler water level control equipment.

159. Fluid Catalytic Cracking. E. Van Dornick, New York, N. Y.—10-page booklet entitled "Modern Fluid Catalytic Cracking" contains a detailed description of fluid catalytic cracking units. A 2-page flowsheet is included.

160. Buildings. Butler Mfg. Co., Kansas City, Mo.—Catalog No. 152 contains 32 pages illustrating and describing the steel buildings made by this company.

161. Tanks. Lee Metal Products Co. Inc., Phillipsburg, Pa.—Bulletin No. LM-4. 4-page booklet illustrates and describes the corrosion resistant storage and mixing tanks made by this company.

162. Water Treating. Cochrane Corporation, Philadelphia, Pa.—Bulletin 4021 is a revised edition describing carbonaceous zeolite water conditioning equipment for softening boiler feed and industrial process water. Contains illustrations of typical installations and a



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HAMMOND designs, fabricates and erects tanks of all types for liquid and dry storage . . . above or below ground . . . high or low pressure . . . cone roof . . . HAMMOND SPHERE . . . floating roof . . . VAPOR-LIFT . . . spheroid . . . GLOBE ROOF PRESSURE . . . gas holder . . . also stainless and stainless-clad vessels of all types and designs for the petro-chemical industries.

number of application flow diagrams. Curves, tables and various chemical reactions involved are included.

163. Electric Motors. Wagner Electric Corp., St. Louis, Mo.—8-page bulletin No. MU-25A features the totally inclosed motors made by this company.

164. Chemicals. Ansul Chemical Co., Marionette, Wis.—5-page bulletin entitled "Grignard Reagents" contains a complete procedure for the preparation of methyl magnesium chloride using methyl chloride as the alkyl halide.

165. Fluorescent Lighting. Lustra Corp. of America, New York, N. Y.—4-page folder featuring the fluorescent lamps made by this company.

166. Speed Control. B. F. Goodrich Co., Akron, Ohio—4-page illustrated folder describing the variable V planetary speed selector made by this company.

167. Ventilation. ILG Electric Ventilating Co., Chicago, Ill.—4-page folder featuring ventilating fans.

168. Flexible Hose. Chicago Metal Hose Corp., Chicago, Ill.—Bulletin G-47 is a full-line catalog featuring this company's line of equipment.

169. Paints. Quigley Co., Inc., New York, N. Y.—6-page folder featuring the paints manufactured by this company.

170. Dehumidification Equipment. Cargocaire Engineering Corp., New York, N. Y.—Two booklets featuring this company's equipment for dehumidifying cargo space in ships for the protection of various types of cargo.

171. Instruments. Combustion Control Corp., Cambridge, Mass.—Bulletin 604, Bulletin 102-C, and Bulletin 104-C illustrate and describe Fireye electronic combustion safeguard controls for oil, gas, and pulverized coal burners.

172. Furnaces. Eclipse Fuel Engineering Co., Rockford, Ill.—Illustrated bulletin describes this company's line of crucible furnace units.

173. Air Conditioning Equipment. Viking Air Conditioning Corp., Cleveland, Ohio—Two bulletins on air conditioning equipment manufactured by this company. The first is a 12-page booklet illustrating and describing the Series V blower assembly made by this company. Features of construction are illustrated and described. Principle of operation is depicted in schematic diagrams. Dimensions are shown and performance data is tabulated. The second of these bulletins features the humidifiers for use in air conditioning systems.

174. Heat Exchangers. D. J. Murray Mfg. Co., Wausau, Wis.—Catalog illustrating and describing the Grid blast coils made by this company. Contains diagrams of installations, performance charts, temperature differential conversion tables, physical data and specifications.

175. Transmission Belting. Hewitt Rubber Div. of Hewitt-Robins, Inc., Buffalo, N. Y.—4-page folder giving the specifications and construction features of Monarch brand transmission belting made by this company. The number of industries using these belts are listed and include pulp and paper mills, stone crushing plants, mines, quarries, foundries, sawmills, etc.

176. Plastics. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del—A publication entitled "The Plastics Bulletin" describes new developments and applications in plastics produced by this company. This bulletin will be issued bimonthly and will include information on new developments and improvements of Du Pont plastics.

177. Textile Chemicals. American Cyanamid Co., Bound Brook, N. J.—Bulletin 116 entitled "Twenty-Five Years of Textile Resin Finishing." Gives a history of the use of resins in textile work.

178. Oil Cleaners. Buckeye Laboratories Corp., Cleveland, Ohio—Bulletin 100 illustrates and describes this company's equipment to clean, dehydrate, degassify and stabilize oils for transformers, circuit breakers, turbines, pumps, and other similar equipment. Known as the Hydro-Volifier, this piece of equipment is illustrated and described in detail. Its use

in various types of service is described and illustrated in flow diagrams.

179. Molded Nylon. The Polymer Corp., Reading, Pa.—8-page reprint entitled "Molded and Machined Nylon" illustrates and describes some of the products made from this material.

180. Lumber. Timber Engineering Co., Washington, D. C.—Over two hundred typical lumber roof trusses are listed for various types of structures in a booklet published by this company. Also includes designs for low-cost prefabricated houses, bridges, towers and railway structures.

181. Instruments. The Powers Regulator Co., Chicago, Ill.—16-page catalog of this company's instruments used in controlling the temperature of water.

182. Industrial Management. Hall & Liles, Detroit, Mich.—Brochure entitled "Changing Attitudes in Industry" discusses increased production and better employee relations. Specialized programs for dealing with these problems are described.

183. Rubber Buckets. B. F. Goodrich Co., Akron, Ohio—Catalog 9425 is a 4-page catalog covering the Flexite rubber, pouring buckets and dippers used for the safe and economical handling of acids, corrosives, liquid explosives and many other highly active liquids.

184. Materials Handling. Speedways Conveyors, Inc., Buffalo, N. Y.—Bulletin 147 is a 4-page leaflet featuring this company's gravity type roller conveyors for use in a wide variety of industries.

185. Radiation Equipment. Radiation Counter Laboratories, Chicago, Ill.—Data Sheet No. 3 illustrates and describes the instruments for routine measurement of radioactivity available from this company.

186. Hose Clamps. Punch-Lok Co., Chicago, Ill.—Catalog 235 contains eight pages illustrating the tools and accessories for use in applying this company's preformed and open end clamps.

187. Welding. Ampco Metal, Inc., Milwaukee, Wis. — Two mimeographed sheets which describe how to weld malleable iron and cast iron. Covers the recommended electrodes for each type of iron, polarity and current, recommended amperage and voltage, preparation, etc.

188. Air Hose. B. F. Goodrich Co., Akron, Ohio—Catalog Section 3460. 4-page leaflet features the various types of air hose manufactured by this company.

189. Protective Coatings. Nukem Products Corp., Buffalo, N. Y.—12-page booklet entitled "Nukemite Acid and Alkali-Proof Resin Coatings." The properties of Nukemite are described and its application in various industries is discussed.

190. Powdered Metal Products. Keystone Carbon, Inc., St. Marys, Pa. New powder metallurgy catalog which illustrates and describes the various powdered metal parts made by this company. Includes self-lubricating porous bronze bearings of various kinds.

191. Germicidal Unit. Lustra Corp. of America, New York, N. Y. Folder 104 illustrates and describes this company's equipment for disinfecting air in the prevention of air-borne diseases. These germicidal units are recommended for use where people work or congregate.

192. Heated Tanks. Aeroil Products Co., West New York, N. J.—2-page leaflet featuring the electrically heated and gas heated vats and tanks made by this company.

193. Instruments. General Controls Co., Glendale, Calif.—Catalog 52C illustrates and describes this company's complete line of automatic pressure, temperature and flow controls for gas, oil, air, water, steam, refrigerants and other fluids for various types of applications. Gives engineering data and includes operating pressures and lists prices for all products manufactured by this company.

194. Vacuum Leak Detector. Consolidated Engineering Corp., 620 North Lake Ave., Pasadena 4, Calif.—10-page illustrated booklet describing the operation, performance, maintenance, specifications and applications of the new portable Consolidated vacuum leak detector in evacuated or pressure systems.

CHEMICAL ECONOMICS

H. M. Batters, MARKET EDITOR

INDUSTRIAL CONSUMPTION OF CHEMICALS REACHED NEW HIGH IN FIRST SIX MONTHS

WHILE COMPLETE data for the first six months of this year are not yet available for operational rates in the industries which are the largest consumers of chemicals, there is sufficient evidence to establish the first half of the year as a record six-months period for the industry. In the first quarter there was a record demand for chemicals for fertilizers, pulp and paper, glass, paint and varnish, and rayon. Other important consuming branches operated at, or close to, capacities. As a result the *Chemical Engineering* index for industrial consumption of chemicals averaged 220.88 which is about 10 percent above any previous three-months high and about 20 percent above the level reported for the first quarter of 1946.

In many cases detailed figures for March deserve special attention. In the case of fertilizer chemicals, the Bureau of the Census announced that production of normal superphosphate was 5 percent above the previous high established last January, and 19 percent above March a year ago. Production of concentrated superphosphate also set a record being 4 percent above the previous high and 33 percent greater than in March 1946. March production of paper and paperboard was 1,801,399 tons – the highest ever reported. Production of wood pulp was 1,013,202 tons, another monthly record. The output of glass containers was 10,640 thousand gross, or considerably above anything previously reached. Sales of paint, varnish, and lacquers went above $91 million and were in line with the expectation that a billion dollar year is in prospect for the industry.

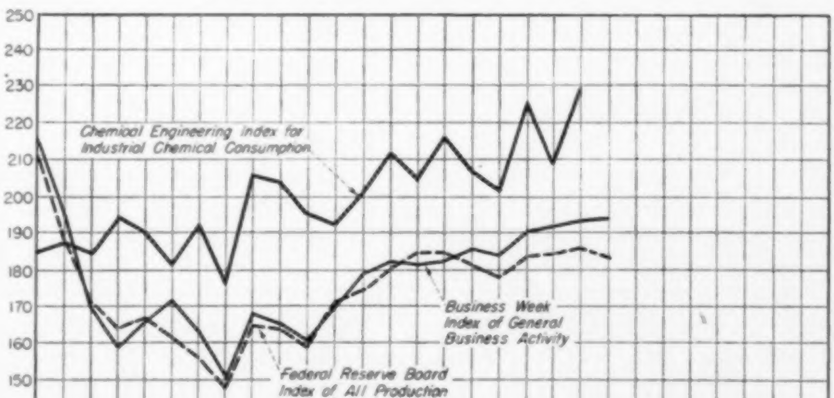
Consumption of rubber for the first quarter of the year was 296,818 long tons compared with 238,255 long tons for the comparable period of last year. In addition 79,351 long tons of reclaimed rubber were consumed as against 64,808 long tons in the 1946 period. However, the rise in consumption of rubber was due to increased use of the natural product as consumption of manufactured rubber was 167,435 long tons compared with 204,977 long tons a year ago. Hence from a chemical standpoint, the gain in consumption of crude rubber is more than offset by the drop in the use of the synthetic product. Consumption of chemicals in paints also can not be considered in direct proportion to the rise in the value of sales as allowance must be made for the rise in prices for the finished products.

In several instances, the high levels reached in the first quarter are too high to be regarded as a fair normal under present conditions. In the first place, production of glass containers has been running ahead of shipments which should bring some slowing in outputs and it is probable that delays will be experienced in adapting plants for a wider diversity in types of containers produced. The fertilizer season has passed its peak and while seasonal influences are not so important as in previous years, they still have some effect, although the industry anticipates that the 1947-48 season will be the best on record. Some divisions of the textile industry have slumped badly because of the falling off in consumer buying and the same is true for plastics. In general, however, both production and consumption of chemicals have shown only a moderate drop in the second quarter if the current position of consuming industries be taken as a basis for comparison.

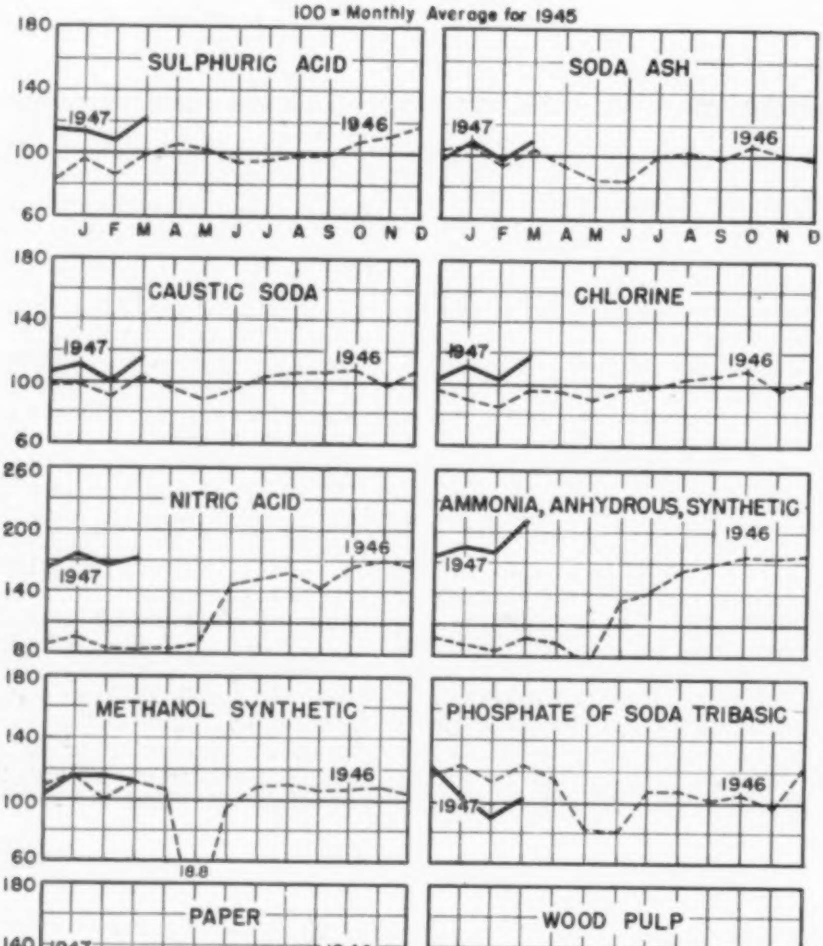
Operations at steel mills have been holding around the levels of the first quarter and petroleum refineries have moved forward with runs to stills higher than at any time since 1945. Production of superphosphate fell but slightly in April and fertilizer tag sales have been holding up well. The output of paperboard actually was larger in April than it was in March and while production of pulp and paper fell off somewhat, a high rate of operation was maintained through May and early June.

Chemical Engineering Index for Industrial Consumption of Chemicals
1935=100

	Jan.	Feb.	March	Jan.-March 1947	Jan.-March 1946	Oct-Dec. 1946
Fertilizers	50.07	49.76	52.96	50.93	44.71	46.94
Pulp and paper	23.10	21.10	23.50	22.57	20.92	22.12
Petroleum refining	19.18	17.60	19.82	18.87	18.08	19.10
Glass	24.90	20.70	23.60	23.07	20.77	22.11
Paint and varnish	23.12	22.52	25.22	23.62	19.27	20.80
Iron and steel	12.90	12.05	13.62	12.86	7.09	11.66
Rayon	22.03	19.50	22.56	21.36	20.05	19.86
Textiles	12.87	11.36	11.90	12.04	10.86	11.52
Coal products	10.15	9.14	10.70	9.99	6.41	9.17
Leather	4.65	4.90	4.70	4.75	4.67	4.51
Explosives	6.89	6.58	6.80	6.76	5.43	6.90
Rubber	6.50	6.30	6.45	6.42	6.90	6.47
Plastics	8.10	7.10	7.74	7.64	5.86	6.83
	224.46	208.61	229.56	220.88	191.02	207.99



PRODUCTION AND CONSUMPTION TRENDS

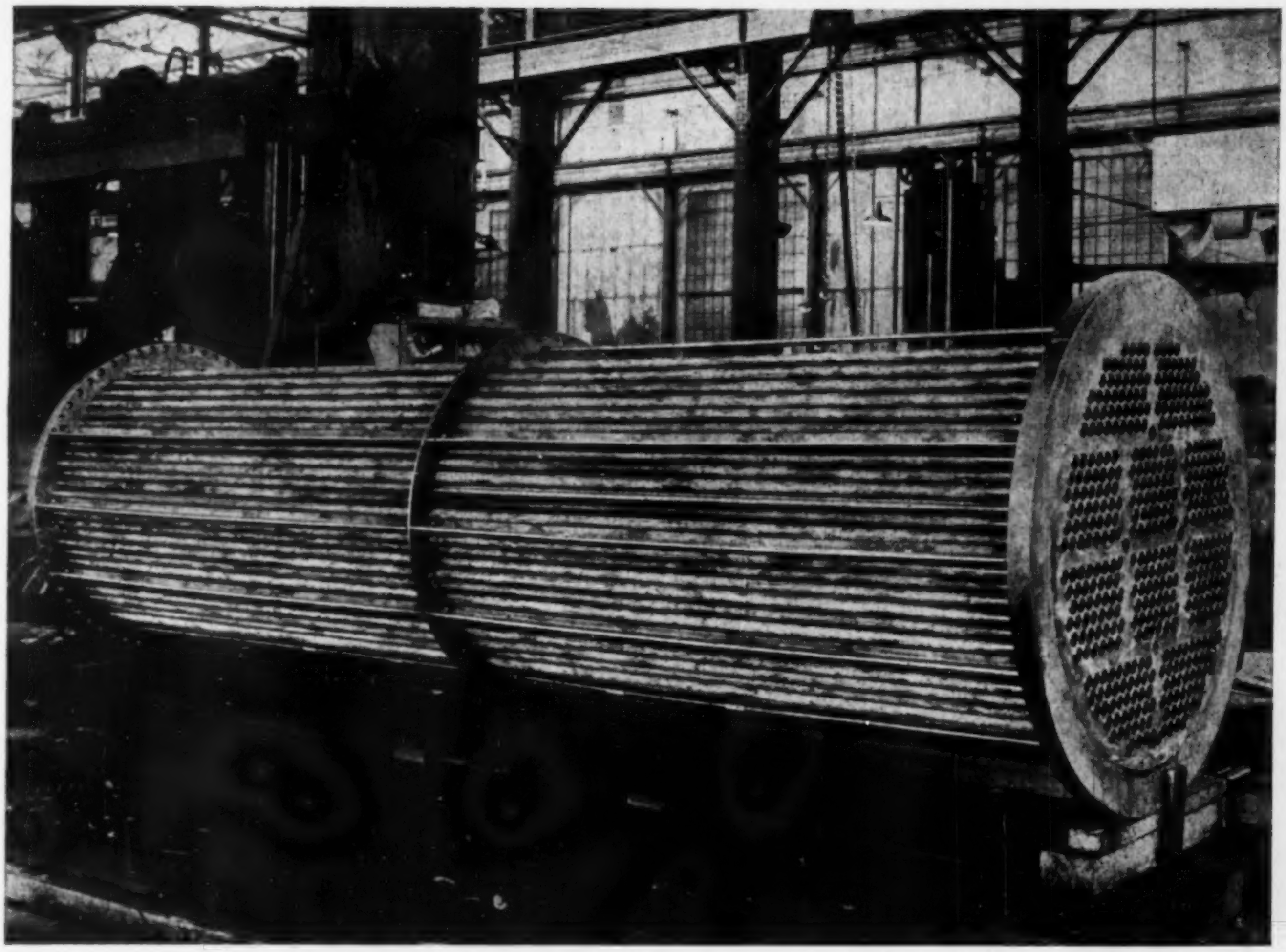


For the first time since February 1946, a drop in employment in manufacturing industries was reported for April. This reversal of the upward trend indicates that production has not maintained the high rate reached in the first quarter of this year. This general summarization holds fairly true for the chemical industry but does not mean that there has been any sharp decline in activities as the current rate of operations is high but there are soft spots where supply has overtaken demand and the pressure on producers has been reduced and the declining trend to prices has influenced consumers to make inroads on inventories and thus further reduce purchasing volume.

While prices for chemicals have advanced about 13 percent in the last six months, these advances were not general and the greater part of the rise was due to upward revisions in alcohol and other solvents, and in the lead, zinc, and copper salts. Some of these chemicals have dropped from their high points and the downward trend no doubt will continue for some time based on variations in producing costs. However, there is little likelihood of a sharp drop in chemical prices because the rise throughout the war period was very moderate.

A decided contrast is shown in the price course of oils and fats after controls were removed. In most cases stocks were very low and consuming requirements were active enough to bid prices up to a dangerous level. With a gradual increase in supply, the price trend has been sharply reversed and if favorable growing conditions are met, the outlook will be favorable for considerably lower prices in the latter part of the year. The improved position of animal fats has directed considerable buying interest to those products and this has tended to bring oils into a more competitive price position.

Turpentine and rosin, which were among the products that soared in price in recent months, weakened as offerings from the new crop began to gain in volume and the sharp reactions have brought out a controversy between the official Savannah Exchange and the naval stores producers. The claim is made that the official prices quoted at Savannah were not truly indicative of real market values and the American Turpentine Farmers Association has announced that it no longer will rely on the Savannah quotations and has set up 75 cents a gallon as its price for turpentine.



ELECTRICITY CAN BE CORROSIVE, TOO

OPERATORS of condensers are well-informed and follow sound general practices that should result in satisfactory tube life, but it has been estimated that in about 90% of American plants there is at least one piece of equipment that shows tube trouble. Such cases interest Revere greatly, because we want condenser tubes to give satisfactory, economical service.

Sometimes the causes of premature failure are obscure and difficult to discover. One of them is stray electricity. When you remember that copper plating is usually done at about 4 to 6 volts, you can see that it doesn't take much to move metal from one place to another through a fluid. Any flow of current through a condenser is sure to be destructive.

Electricity often finds strange routes to ground through high-resistance shorts that do not show up through blown fuses, overheated parts, arcing, and similar obvious indications. Pump motors, for example, may work perfectly well, but permit a little "corrosive" electricity to pass along to ground through the condenser; electrolysis results. Galvanic action, due to the use of metals of too-great dissimilarity, may also occur, but is rare in a condenser properly designed for its operating conditions.

So Revere suggests you include electricity as a possibility when seeking the causes of unexpected tube failure. And it is also advisable to save samples cut from failed tubes, to be sent to Revere for laboratory examination. Facts thus scientifically uncovered may lead to recommendations that will solve the problem. If you have a condenser tube problem, ask Revere to help.

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United States Production of Certain Chemicals

March 1947, March 1946 and Three-Month Totals for 1947 and 1946

Chemical (Tons unless otherwise noted)	March 1947	March 1946	Totals, Three Months 1947	Totals, Three Months 1946
Ammonia, synthetic, anydrous[1]	95,850	44,271	263,643	125,393
Ammonium nitrate (100% NH_4NO_3)	90,333	24,863	264,180	101,101
Ammonium sulphate, synthetic technical (M lb.)	34,764	24,863	86,042	73,764
Calcium arsenate ($Ca_3(AsO_4)_2$ (M lb.)	1,221	1,610	4,529	3,701
Calcium carbide, commercial	52,466	44,460	148,552	129,968
Calcium phosphate:				
Monobasic (100% $CaH_4(PO_4)_2$) (M lb.)	6,999	6,610	19,524	18,521
Dibasic (100% $CaHPO_4$) (M lb.)	5,128	7,233	21,021	24,066
Carbon dioxide:				
Liquid and gas (M lb.)	15,704	17,623	47,363	51,020
Solid (M lb.)	46,740	47,714	125,430	124,671
Chlorine	117,039	96,439	328,844	270,887
Chrome green (C.P.) (M lb.)	1,299	1,981	3,229	5,432
Chrome yellow and orange (C.P.) (M lb.)	3,483	4,739	10,377	13,503
Hydrochloric acid (100% HCl)	36,903	26,805	106,108	80,424
Hydrogen (M cu. ft.)	1,683,000	1,475,000	4,898,000	4,208,000
Lead arsenate, acid and basic (M lb.)	4,481	8,755	13,095	22,743
Molybdate chrome orange (C.P.) (M lb.)	422	485	1,259	1,346
Nitric acid (100% HNO_3)	64,647	30,899	190,978	96,791
Oxygen (M cu. ft.)	1,218,000	951,000	3,329,000	2,272,000
Phosphoric acid (50% H_3PO_4)	89,517	79,500	243,335	227,277
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	383,753	380,489	1,113,976	1,110,126
Finished light[3]	184,018	183,038	546,681	547,743
Finished dense	142,184	140,500	401,154	395,885
Natural[4]	23,071	15,971	60,365	49,216
Sodium bicarbonate, refined	16,571	18,360	47,385	47,301
Sodium bichromate and chromate	7,129	7,777	20,062	22,646
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	115,198	93,335	320,616	261,009
Solid	18,240	15,427	52,895	47,897
Lime soda process:				
Liquid[5]	64,202	66,674	189,019	196,747
Solid	20,067	19,365	50,868	58,844
Sodium phosphate:				
Monobasic (100% NaH_2PO_4)	1,242	985	3,614	3,345
Dibasic (100% Na_2HPO_4)	6,956	5,974	19,228	16,963
Tribasic (100% Na_3PO_4)	7,672	9,165	22,083	26,810
Meta (100% $NaPO_3$)	2,741	2,416	7,053	7,335
Tetra (100% $Na_4P_2O_7$)	4,252	4,632	12,254	14,100
Sodium silicate, anhydrous	42,120	32,182	117,995	97,155
Sodium sulphate:				
Anhydrous, refined	11,967	12,191	34,611	32,002
Glauber's salt	19,152	13,655	52,923	40,794
Salt cake, crude, commercial	50,907	45,643	146,619	123,643
Sulphuric acid:[7]				
Chamber process	306,600	249,318	877,341	744,970
Contact process, new[6]	574,933	454,519	1,634,015	1,371,758
Zinc yellow (zinc chromate) (C.P.)	257	....	774	....

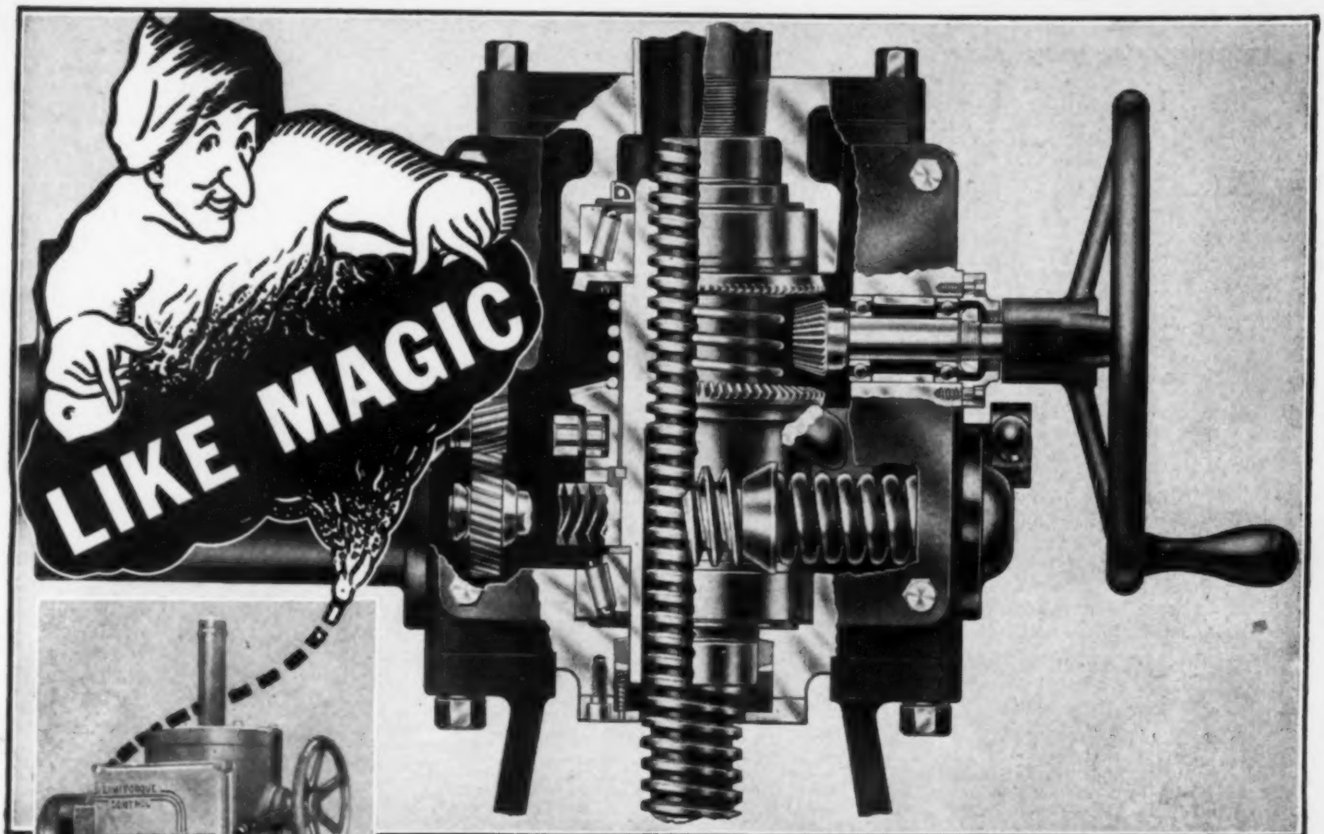
Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Includes oleum grades, excludes spent acid. [7] Data for sulphuric acid manufactured as a byproduct of smelting operations are included. [8] Revised.

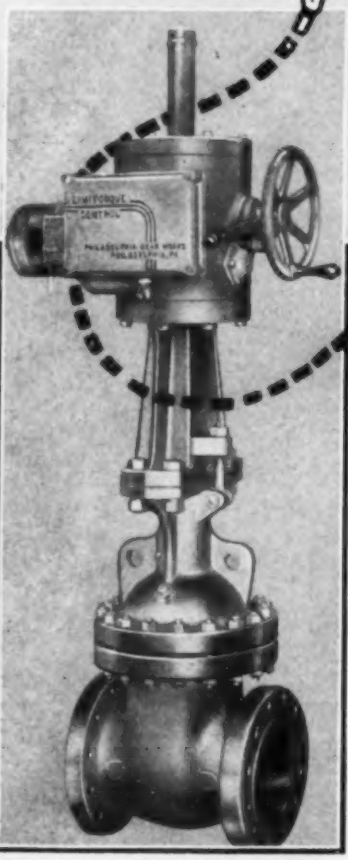
United States Production of Certain Synthetic Organic Chemicals

February 1947, February 1946 and Two-Month Totals for 1947 and 1946

	February 1947	February 1946	Totals, Two Months 1947	Totals, Two Months 1946
Acetanilid, technical and U.S.P.	559,542	488,658	1,287,232	1,170,913
Acetic acid:				
Synthetic	28,685,625	21,344,987	61,685,056	40,888,526
Recovered	107,722,325	86,048,934	229,134,756	184,172,904
Natural	1,984,112	1,798,494	4,138,562	3,606,027
Acetic anhydride	45,662,447	38,330,052	94,819,727	84,063,477
Acetone	27,876,019	26,833,544	59,507,829	52,679,975
Acetylsalicylic acid	1,023,817	933,846	1,949,272	1,920,214

(Continued on page 310)





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VALVES ARE OPENED AND CLOSED Automatically, Safely and Quickly by LIMITORQUE

Opening or closing a valve by hand is often a slow, tiresome and hazardous task requiring the valuable time of one (and often two) men . . . On high pressure, high temperature steam lines, where valves and wheels are very hot, LimiTorque does the work "like magic" . . . And, hundreds upon hundreds of LimiTorque Controls are used throughout the U. S. A. on all types of Steam, Oil, Water, Gas and Process Lines.

Operation is simple and dependable (see cut-away view above of the famous Type S. M. LimiTorque).

Motor is coupled to worm shaft through helical gears. In closing, worm drives worm gear until lugs on the gear meet matching lugs on clutch. Torque is transmitted to the nut through splines connecting the clutch to stem nut. Torque spring is then compressed by axial movement of worm on worm shaft. When torque spring has been compressed to predetermined setting, torque switch is actuated by a tripping collar on worm shaft. This interrupts current to holding coil of controller and stops motor. Inertia of motor is absorbed in further compression of the torque spring. Opening travel is governed by geared limit switch.

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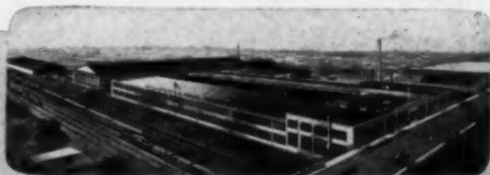

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

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U. S. Production of Synthetic Organic Chemicals (Cont. from page 308)

	February 1947	February 1946	Totals, Two Months 1947	1947
Aniline	8,458,738	6,411,340	17,221,248	13,482,044
Barbituric acid derivatives:[5]				
5-Ethyl-5-phenylbarbituric acid and salts (Phenobarbital)	24,754	26,119	63,926	55,167
Benzene:				
Motor grade:				
Tar distillers[4]	712,333	953,062	1,398,610	2,017,681
Coke-oven operators[6]	1,490,390	1,470,881	4,663,346	4,107,329
All other grades:				
Tar distillers[4]	1,999,400	1,966,576	3,827,571	3,492,090
Coke-oven operators[6]	11,211,211	4,342,660	23,843,194	11,107,801
Butyl alcohol, primary, normal	8,729,231	7,709,980	12,706,433	17,298,975
Carbon bisulphide	26,613,022	23,775,087	55,800,549	50,539,703
Carbon tetrachloride	17,664,871	13,368,298	33,430,323	25,010,961
Chlorobenzene, mono	22,224,220	19,932,173	47,576,554	41,968,749
Creosote oil:				
Tar distillers	11,691,769	7,665,168	22,388,507	17,517,288
Coke-oven operators	2,888,472	798,641	6,229,579	2,714,489
Cresols:				
Meta-para	422,861	299,492	809,272	573,151
Ortho-meta-para	724,387	757,243	1,388,909	1,308,924
Cresylic acid, refined[7,10]	2,141,772	1,291,937	4,235,793	2,820,709
Dibutyl phthalate	1,949,696	1,452,979	3,994,371	....
Dichlorodiphenyltrichloroethane (DDT)	3,933,467	3,221,865	8,026,709	6,711,453
Ethyl acetate (85%)	7,083,659	6,411,541	17,268,859	12,832,143
Ethylene glycol	14,670,291	....	32,224,919	....
Ethyl ether	3,517,751	2,571,081	7,536,980	5,884,078
Formaldehyde (37% by wt.)	41,665,947	38,253,695	88,006,571	77,464,600
Hexachlorocyclohexane	206,578	....	354,411	....
Methanol:				
Natural[8]	1,147,306	1,228,466	2,614,786	2,630,947
Synthetic	44,361,941	41,557,771	92,904,084	89,611,937
Naphthalene:				
Tar distillers, less than 79° C	17,092,237	10,074,249	35,806,196	26,059,916
Tar distillers, 79° C. and over	7,884,167	8,124,961	16,574,895	16,444,835
Coke-oven operators, less than 79° C	6,446,832	2,221,779	13,712,983	6,399,032
Penicillin	2,228,933	1,702,983	5,100,967	3,215,988
Phenol, synthetic and natural	15,731,032	13,804,240	34,301,814	29,874,729
Phthalic anhydride	10,846,590	7,094,298	22,534,075	16,155,596
Styrene, government owned plants	16,290,806	25,867,056	50,042,066	52,927,584
Toluene, coke-oven operators	2,063,739	915,245	4,073,801	2,210,422
Toluene, all other[9]	3,143,378	837,926	6,121,115	1,969,118
Xylene, crude, from coal-tar and petroleum	4,806,485	....	8,822,942	....

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.), and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1] Excludes the statistics on recovered acid. [2] Acid produced by direct process from wood and from calcium acetate. [3] All acetic anhyride including that from acetic acid by vapor-phase process. [4] Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5] Statistics are given in terms of bulk medicinals only. [6] Statistics collected by Bureau of Mines. [7] Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8] Reported to U. S. Bureau of the Census. [9] Includes toluene produced from petroleum by any process. [10] Includes refined cresylic acid from petroleum.

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THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

CHEMICAL ENGINEERING

Weighted Index of Prices for

CHEMICALS

Base = 100 for 1937

This month	**124.02**
Last month	123.54
June, 1946	109.13
June, 1945	108.93

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to June 9.

INDUSTRIAL CHEMICALS

Acetone, tank, lb	\$0.07 – \$0.09
Acid, acetic, 28%, bbl., 100 lb	3.78 – 4.03
Boric, bbl., ton	119.00 –123.00
Citric, drums, lb	.24½– .26
Formic, cbys., lb	.12 – .12½
Hydrofluoric, 30%, drums, lb	.08 – .085
Lactic, 44% tech., light, bbl., lb.	.0815– .0855
Muriatic 18°, tanks, 100 lb	1.00 –.......
Nitric, 36°, carboys, lb	.05 – .05
Oleum, tanks, wks., ton	19.50 – 20.00
Oxalic, crystals, bbl., lb	.13 – .14
Phosphoric tech., tanks, lb	.0465–.......
Sulphuric, 60°, tanks, ton	13.00 –.......
Tartaric, powd., bbl., lb	.49½– .50
Alcohol, amyl from pentane, tanks, lb	.151–.......
Alcohol, butyl, tanks, lb	.14½– .20
Alcohol, ethyl, denatured, No. 1 special tanks, gal	.98½–.......
Alum, ammonia, lump, lb	.04¼–.......
Aluminum sulphate, com. bags, 100 lb	1.15 – 1.25
Ammonia, anhydrous, cyl., lb	.16 – .20
tanks, ton	59.00 – 61.50
Ammonium carbonate, powd., casks, lb	.09¼– .10
Sulphate, wks, ton	30.00 – 32.00
Amyl acetate, tech. from pentane, tanks, lb	.21 –.......
Aqua ammonia, 26°, drums, lb	.03 – .03½
tanks, ton	65.00 –.......
Arsenic, white powd., bbl., lb	.06 – .07
Barium carbonate, bbl., ton	67.50 – 75.00
Chloride, bags, ton	85.00 – 90.00
Nitrate, casks, lb	.11½– .12
Blanc fixe, dry, bags, ton	67.50 – 72.50
Bleaching powder, f.o.b. wks., drums, 100 lb	2.75 – 3.00
Borax, gran., bags, ton	48.50 –.......
Calcium acetate, bags, 100 lb	3.00 –.......
Arsenate, dr., lb	.09½– .10
Carbide, drums, ton	50.00 –.......
Chloride, flake, bags, del., ton	21.50 – 38.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride, drums, lb	.06½– .07
Chlorine, liquid, tanks, wks., 100 lb	2.00 – 2.30
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate bbl., lb	.26 – .27
Sulphate, bags, 100 lb	7.60 – 7.75
Cream of tartar, bbl., lb	.41½– .42
Diethylene glycol, dr., lb	.14 – .15
Epsom salt, dom., tech., bbl., 100 lb	2.05 – 2.25
Ethyl acetate, tanks, lb	.09½– .19
Formaldehyde, 30%, tanks, wks., lb	.0545–.......
Furfural, tanks, lb	.09½–.......
Glaubers salt, bags, 100 lb	1.25 – 1.50
Glycerine, c. p., drums, extra, lb	.40 – .45
Lead:	
white, basic carbonate, dry casks, lb	.15¼–.......
Red, dry, sck., lb	.18 –.......
Lead acetate, white crys., bbl., lb.	.19¼– .20¼
Arsenate, powd., bags, lb	.21¼– .22
Lithopone, bags, lb	.05½– .06
Magnesium carb., tech., bags, lb	.07¼– .08
Methanol, 95%, tanks, gal	.60 –.......
Synthetic, tanks, gal	.24 – .29
Phosphorus, yellow, cases, lb	.22 – .25
Potassium bichromate, bags, lb	.10¼– .10¾
Chlorate, powd., lb	.09 – .09¼
Hydroxide (c'stic potash) dr., lb	.07¼– .09½
Muriate, 60%, bags, unit	.37¼–.......
Nitrate, ref., bbl., lb	.08¼– .21
Permanganate, drums, lb	.20¼– .21¼
Prussiate, yellow, casks, lb	.19 – .20
Sal ammoniac, white, casks, 100 lb	4.75 – 5.00
Salsoda, bbl., 100 lb	1.10 – 1.20
Salt cake, bulk, ton	20.00 –.......
Soda, ash, light, 58%, contract, bags, 100 lb	1.20 –.......
Dense, bags, 100 lb	1.28 –.......
Soda, caustic, 76% solid, drums, 100 lb	2.50 –.......
Acetate, del., lb	.05½– .06
Bicarbonate, bags, 100 lb	2.25 –.......
Bichromate, bags, lb	.08¼– .08¾
Bisulphate, bulk, ton	20.00 – 24.00
Bisulphite, bbl., lb	.03 – .04

CHEMICAL ENGINEERING
Weighted Index of Prices for
OILS & FATS

Base = 100 for 1937

This month	**237.60**
Last month	272.16
June, 1946	145.80
June, 1945	145.85

Chlorate, kegs, lb	$0.06½ –	$0.06½
Cyanide, cases, dom., lb	.14½ –	.15
Fluoride, bbl., lb	.09½ –	.09¾
Hyposulphite, bags, 100 lb	2.25 –	2.50
Metasilicate, bbl., 100 lb	3.40 –	4.00
Nitrate, bulk, ton	32.00 –	38.50
Nitrite, casks, lb	.06¼ –	.07
Phosphate, tribasic, bags, 100 lb	3.50 –	......
Prussiate, yel., bags, lb	.12 –	.12½
Silicate, 40°, dr., wks., 100 lb	.95 –	1.00
Sulphite, crys., bbl., lb	.02¼ –	.02½
Sulphur, crude at mine, long ton	16.00 –	......
Dioxide, cyl., lb	.085 –	.09
Dioxide, tanks, lb	.044 –	......
Tin crystals, bbl., lb	.55 –	......
Zinc chloride, gran., bbl., lb	.07 –	.07½
Oxide, lead free, bags, lb	.09½ –	.09¾
Oxide, 35% leaded, bags, lb	.11½ –	.11¾
Sulphate, bags, cwt	4.15 –	7.00

OILS AND FATS

Castor oil, No. 3 dr., lb	$0.29½ –	......
Chinawood, oil, tanks, lb	.27 –	......
Coconut oil, Ceylon, N. Y., lb	.14½ –	......
Corn oil, crude, tanks, (f.o.b. mill), lb	.20½ –	......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.21½ –	......
Linseed oil, raw, car lots, dr., lb	.334 –	......
Palm, casks, lb	nom.	
Peanut oil, crude, tanks (mill), lb.	.23 –	......
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.20 –	......
Menhaden, light, pressed dr., lb	.27½ –	......
Crude, tanks (f.o.b. factory), lb.	nom	
Grease, yellow, loose, lb	.11½ –	......
Oleo stearine, lb	nom.	
Oleo oil, No. 1, lb	.19 –	......
Red oil, distilled, bbl., lb	.21½ –	......
Tallow, extra, loose, lb	.12½ –	......

COAL TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb	$0.58 –	$0.60
Alpha-naphthylamine, bbl., lb	.35 –	.36
Aniline oil, drums, lb	.13 –	.13½
Aniline salts, bbl., lb	.22 –	.24
Benzaldehyde, tech., dr., lb	.45 –	.50
Benzidine base, bbl., lb	.75 –	.77
Benzoic acid, USP, kegs, lb	.54 –	.56
Benzol, 90%, tanks, works, gal	.19 –	......
Benzyl chloride, tech., dr., lb	.20 –	.21
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, USP, dr., lb	.13½ –	......
Cresylic acid, dr., wks., gal	1.00 –	1.05
Diphenyl, bbl., lb	.16 –	......
Diethylaniline, dr., lb	.48 –	.50
Dinitrotoluol, bbl., lb	.18 –	.19
Dinitrophenyl, bbl., lb	.22 –	.23
Dip oil, 15%, dr., gal	.23 –	.25
Diphenylamine, dr., f.o.b. wks., lb.	.25 –	......
H acid, bbl., lb	.50 –	.52
Hydroquinone, bbl., lb	.90 –	.95
Naphthalene, flake, bbl., lb	.09½ –	.10
Nitrobenzene, dr., lb	.08½ –	.09
Para-cresol, bbl., lb	.41 –	......
Para-nitroaniline, bbl., lb	.42 –	.43
Phenol, USP, tanks, lb	.10½ –	.11
Picric, acid, bbl., lb	.30 –	.32
Pyridine, dr., gal	1.55 –	1.60
Resorcinol, tech., kegs, lb	.68 –	.70
Salicylic acid, tech., bbl., lb	.26 –	.27
Solvent naphtha, w.w., tanks, gal.	.23 –	......
Toluidin, bbl., lb	1.00 –	......
Toluol, drums, works, gal	.23 –	......
Xylol, com., tanks, gal	.23 –	......

MISCELLANEOUS

Casein, tech., bbl., lb	$.24½ –	$.30
Dry colors:		
Carbon gas, black (wks.), lb	.04 –	.07
Prussian blue, bbl., lb	.42 –	.43
Ultramarine blue, bbl., lb	.13 –	.24
Chrome green, bbl., lb	.31 –	.40
Carmine red, tins, lb	5.50 –	6.00
Para toner, lb	.80 –	.95
Vermilion, English, bbl., lb	2.50 –	2.70
Chrome yellow, C. P., bbl., lb	.26 –	.28
Gum copal, Congo, bags, lb	.09 –	.55
Manila, bags, lb	.09 –	.15
Damar, Batavia, cases, lb	.10 –	.22
Kauri, cases, lb	.18 –	.60
Magnesite, calc., ton	60.00 –	......
Pumice stone, lump, bbl., lb	.05 –	.07
Rosin, H., 100 lb	9.25 –	......
Shellac, orange, fine, bags, lb	.60 –	.62
Bleached, bonedry, bags, lb	.65 –	.68
T. N. bags, lb	.58 –	.60
Turpentine, gal	.75 –	......

NEW CONSTRUCTION

	Current Projects		Cumulative 1947	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	....	....	$8,895,000	$2,217,000
Middle Atlantic	$702,000	$263,000	6,114,000	11,363,000
South	2,055,000	1,550,000	10,711,000	9,257,000
Middle West	1,565,000	....	16,048,000	8,882,000
West of Mississippi	12,879,000	10,685,000	190,977,000	68,217,000
Far West	1,166,000	286,000	4,006,000	10,872,000
Canada	....	....	51,846,000	13,111,000
Total	$18,367,000	$12,784,000	$288,597,000	$123,919,000

Proposed Work

Ark., Texarkana—State Line Pottery Plant, Texarkana, plans to reconstruct its plant. Estimated cost $55,000.

Calif., Barstow—Western Talc Co., 1901 East Slauson Ave., Los Angeles, plans to construct a factory. Estimated cost $90,900.

Calif., San Francisco—Shell Oil Co., Inc., 100 Bush St., plans to construct an agricultural laboratory. Estimated cost $75,000.

Ga., Albany—Dixie Leather Co., c/o K. B. Hodges, Pres., Albany Chamber of Commerce, plans to construct a leather manufacturing plant. Estimated cost $55,000.

Ind., Indianapolis—Eli Lilly & Co., Indianapolis, plans to construct a drug research building. Estimated cost $239,700.

Ind., Wabash—Container Corp. of America, Wabash, plans to improve its paper mill. Estimated cost $100,000.°

Ia., Des Moines—Marquette Cement Manufacturing Co., 140 South Dearborn St., Chicago, Ill., plans to construct a cement manufacturing plant, including railroad scale, loading equipment, etc. A. J. Boynton & Co., 58 East Washington St., Chicago, Eng. Estimated cost between $60,000 and $70,000.

Mich., Detroit—International Salt Co., 2680 Penobscot Bldg., plans to construct a salt storage silo and dock and a salt mill. Allen & Garcia, 332 South Michigan Ave., Chicago, Cons. Engrs. Estimated cost $225,000.

Minn., Red Wing—Pittsburgh Plate Glass Co., 616 South Third St., Minneapolis, plans to construct a 1 story addition to its plant. Estimated cost $69,000.

N. J., Deepwater—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., plans to construct an addition to its plant here. Estimated cost $60,155.

N. Y., Niagara Falls—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., plans to construct two industrial buildings here. Estimated cost $145,430 and $187,000 respectively.

O., Ironton—Barrett Div. of Allied Chemical & Dye Corp., Ironton, plans to construct a phthlic anhydride plant to produce plastic materials for paints and varnishes. Estimated cost $1,000,000.

Pa., Ardmore—Certain-Teed Products Corp., 120 South LaSalle St., Chicago, Ill., plans to construct a plant here. Estimated cost $309,000.

Tenn., Morristown—Stauffer Chemical Co., c/o J. D. Kreis, Pres., Morristown Chamber of Commerce, plans to construct a chemical plant. Estimated cost $2,000,000.

Tex., Houston—Sinclair Refining Co., Gulf Bldg., plans to construct a new refinery. Estimated cost $10,000,000.

Tex., Port Arthur—Gulf Oil Corp., Port Arthur, plans to construct crude oil stills. Estimated cost $750,000.

Tex., Texas City—Sid Richardson Refining Co. plans to reconstruct its products storage plant. Estimated cost $125,000.

Wash., Seattle—Monsanto Chemical Co., 1700 South Second St., St. Louis, Mo., plans to construct a factory and warehouse here. J. Worth, Maritime Bldg., Seattle, Res. Eng. Estimated cost $1,000,000.

Wyo., Casper—Standard Oil Co. of Indiana, Casper, plans to reconstruct its refinery here. Estimated cost $1,750,000.

Contracts Awarded

Ala., Tarrant City—Lehigh Portland Cement Co., c/o Daniel Construction Co., 822 7th Ave., S., Birmingham, Ala., contractor, will construct an addition to its plant here. Estimated cost $100,000.

Ark., Magnolia—D. E. Buchanan, Magnolia, has awarded the contract for a natural gasoline recovery plant to Petroleum Engineering, Inc., National Bank of Tulsa Bldg., Tulsa, Okla. Estimated cost $2,225,000.

Calif., Pittsburg—Dow Chemical Co., Great Western Div., Industrial Rd., has awarded the contract for an xanthrates ore plant addition to Austin Co., 618 Grand Ave., Oakland. Estimated cost $220,000.

Fla., Jacksonville—Duval Engineering & Contracting Co., Jacksonville, will construct an asphalt and asphalt cement processing plant. Work will be done by owner. Estimated cost $60,000.

Kan., McPherson—Bay Petroleum Corp., Midland Savings Bldg., Denver, Colo., has awarded the contract for a 1,000 bbl. reformer unit at its refinery to Refinery Engineering Co., 600 South Michigan Ave., Chicago, Ill. Estimated cost $750,000.

Miss., Meridian—Standard Oil Co., 65th St., has awarded the contract for a barreling plant to L. B. Priester & Sons, Meridan. Estimated cost $90,000.

Mo., Louisiana—Bureau of Mines, Department of Interior, Washington, D. C., has awarded the contract for converting Missouri Ordnance Works into a high pressure hydrogenation demonstration plant for the production of synthetic liquid fuels from coal and lignite to The Hechtel Corp., 3780 West Wilshire Blvd., Los Angeles, Calif. Estimated cost $6,700,000.

Mo., St. Louis—Mallinckrodt Chemical Works, 3600 North Second St., has awarded the contract for a 1 story, 83x126 ft. chemical plant to Dickie Construction Co., 317 North 11th St. Estimated cost $55,000.

Mo., St. Louis—Monsanto Chemical Co., 1700 South Second St., has awarded the contract for a laboratory building at its chemical plant to I. E. Millstone Construction Co., 4343 Clayton Ave.

Mo., St. Louis—Walsh Refractories Corp., 4070 North Bway., has awarded the contract for a dryer building at its plant to Fruin-Colnon Contracting Co., 1706 Oliver St. Estimated cost including equipment $100,000.

Ore., Portland—Electro Metallurgical Co., 30 East 42nd St., New York, N. Y., has awarded the contract for a warehouse to Donald M. Drake Construction Co., Lewis Bldg. Estimated cost $66,000.

Pa., Columbia—Marietta Silk Co., Inc., Columbia, has awarded the contract for a rayon plant to Wm. Linker Co., Inc., 2036 Arch St., Philadelphia. Estimated cost $58,000.

Pa., Conshohocken—Kimball Glass Co., Roof Glass Div. of Owens Illinois Glass Co., Conshohocken, has awarded the contract for a plant addition to Frank J. Larkin Construction Co., 1518 Parrish St., Philadelphia. Estimated cost will exceed $55,000.

Pa., Philadelphia—Container Corp. of America, Nixon and Fountain Sts., has awarded the contract for alterations and addition to its paper mill building to Lauter Construction Co., Otis Bldg. Estimated cost $150,000.

S. C., Hartsville—Sonoco Products Co., manufacturers of paper specialties, has awarded the contract for an addition to its board plant to Fiske-Carter Construction Co., Spartanburg, S. C. Estimated cost $1,300,000.

Tex., Houston—Diamond Alkali Co., 1006 Main St., Houston and Pittsburgh, Pa., has awarded the contract for a chemical plant to Brown & Root, Inc., 4300 Calhoun Rd., Houston. Estimated cost $4,000,000.

Wyo., Casper—Socony-Vacuum Oil Co., Inc., White Eagle Div. Refinery, has awarded the contract for modernization and expansion of its refinery to Catalytic Construction Co., Casper. Estimated cost $3,500,000.

THE CLOSED SHOP

Key to Labor Monopoly

IF THE PEOPLE of the United States are to loosen the monopoly control now exercised by some segments of union labor and recapture the power to control their own economic and political destiny, they must come to grips with the problem of the closed shop. A satisfactory solution of that problem is as vital to the interests of the wage earner, who should be fully protected in his right to organize and bargain collectively through representatives of his own choosing, as it is vital to the interests of the nation as a whole.

By the closed shop, which unfortunately is a term that seems to shed more heat than light, I mean any shop in which the worker must make his peace with a union in order to have a job. There are approximately 13½ million union members in the United States. Of these about 10 million are governed by arrangements calling for "closed" shops, union shops, maintenance of membership provisions and similar devices which make good standing in a union a condition to holding a job.

Such arrangements raise serious issues about what is commonly presumed to be the basic American right to work. Also, closed shop arrangements lie at the root of the dominant economic power now exercised by some labor leaders.

The problem of reducing the power of these labor leaders to proportions that make it safe for democracy is the age-old problem of monopoly. In an earlier era this problem was created largely by businessmen who sought to escape the restraints of competition by combinations or agreements to control prices and production. Such efforts are still attempted and must be curbed by law.

Union Labor Monopoly

But, after more than a decade during which a monopoly position for organized labor has been aggressively promoted by the federal government, the major monopolists today are those labor leaders who wield the power of enormous nationwide unions. About 90% of the soft coal miners do the bidding of John L. Lewis. A like percentage of the auto workers are represented by the United Automobile Workers of the C. I. O. About 80% of the production workers in steel are members of the United Steel Workers, C. I. O. No single corporation has more than a fraction of the economic power that is concentrated in these unions. And if corporations were to combine their power to cope effectively with that of these union monopolies they would unquestionably find themselves charged with violating the federal antitrust laws.

In its national sweep, the monopoly power of unions rests largely on their exemption from the federal antitrust laws. My previous editorial in this series (the 53rd) discussed the desirability of removing that exemption. The local roots of this monopoly power are often embedded in closed shop arrangements.

Closed Shop in Coal

An illuminating case in point is provided by the United Mine Workers, whose leader John L. Lewis has graciously given the country a 3½-month reprieve from "the hysteria and frenzy of an economic crisis," as he himself termed it. During that latest crisis the dispatches from the soft coal fields reported that the miners were standing behind John L. Lewis almost to a man. And the implication usually was that the driving forces of the strike were loyalty to Lewis and the prospect of economic gain.

Underlying that performance, however, and basic to it was an agreement in the soft coal fields providing that "as a condition of employment all employees shall be members of the United Mine Workers." Hence to hold a job in 90% of the soft coal industry which is governed by contracts with the United Mine Workers, a miner must not offend the union. To avoid offense the union member must even be careful in criticising what his union

does. *Suspension from the union for six months, and hence from the right to hold a job,* is the penalty imposed by the United Mine Workers constitution for circulating a statement "wrongfully condemning any decision rendered by any officer of the organization."

The willingness of the miners to follow Lewis until the country froze over was not, of course, exclusively a product of the agreement limiting jobs in the coal fields to union members of good standing. Some of it originated in bad handling of employee relations in the coal fields in years gone by. But the fact remains that Lewis' soft coal monopoly has as one of its principal foundations an agreement which gives the United Mine Workers a job-or-no-job hold on 90% of the soft coal miners.

In its extreme form, the closed shop not only makes union membership a condition of employment but narrowly limits the numbers admitted to union membership and hence to the opportunity to work. In this way it is used to enforce restriction of output and working rules which would never stand up under free competition.

Fair Dealing

The closed shop raises major issues of personal freedom and fair dealing between individuals. As matters now stand, closed shop agreements require employers to discharge workers who lose their good standing in the unions involved. At the same time they frequently impose no requirement on unions to grant membership to law abiding and technically qualified persons. Many unions with closed shop agreements refuse to grant membership on the basis of competence. Thus, qualified workers are denied a fair chance to hold a job.

In its dealings with the closed shop issue the federal government has been pushed into a self-contradictory position. The National Labor Relations Act (the Wagner Act) provides, and properly, that "employees shall have the right . . . to bargain collectively through representatives of their own choosing." In furtherance of that basic proposition, the Wagner Act also provides that "It shall be an unfair labor practice for an employer . . . by discrimination in regard to hire or tenure of employment to encourage or discourage membership in any labor organization . . ." Standing alone, the provision would clearly outlaw the closed shop.

But then, to favor the closed shop, the Wagner Act turns right around and provides that "nothing in this Act . . . shall preclude an employer from making an agreement with a labor organization . . . to require, as a condition of employment, membership therein," provided that certain conditions of representation are fulfilled. This places the National Labor Relations Board in the impossible position of trying to administer a law which simultaneously points in opposite directions.

In successfully contending that there should be no closed shop arrangements on the railroads, the late Joseph Eastman, Federal Co-ordinator of Transportation, said, "If genuine freedom of choice is to be the basis of labor relations under the Railway Labor Act, as it should be, then the yellow dog contract and his corollary, the closed shop . . . have no place in the picture." The so-called yellow dog contract, which requires a worker to agree not to join a union as a condition of employment, has long since been outlawed.

At one time the closed shop was defended as a protective device for feeble young unions struggling against predatory employers. But a mere glance over the current economic scene discloses that the time when that argument was supported by the facts is past. Now it is the labor leaders who frequently exercise decisive economic power.

At elections in November three more states, Arizona, Nebraska and South Dakota, passed constitutional amendments outlawing the closed shop. In doing so, they joined six other states, which, in one way or another, have restricted the closed shop. The South Dakota amendment presented the basic issue created by the closed shop in simple and direct terms when it declared that "The right of persons to work shall not be denied or abridged on account of membership or non-membership in any labor union, or labor organization."

That issue must be squarely faced by the new Congress if its first order of business, the labor crisis, is to be resolved.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 54TH OF A SERIES

INDUSTRY-WIDE BARGAINING...

Death Trap for Business, Suicide for Free Labor

IF CONGRESS is to succeed in its present efforts to prevent strikes in key industries from devastating the nation, it will have to put a crimp in industry-wide collective bargaining. This kind of bargaining is designed to apply agreements between employers and organized workers on wages and working conditions to an entire industry.

Further, if extension of this type of bargaining is not curbed, there is reason to believe that it will undermine the freedom of both American business enterprise and American wage earners. For, while increasing the destructive power of labor disputes, the general spread of industry-wide bargaining would so concentrate the fixing of wages—by far the largest element in the cost of production—that government regulation would be a next short step. With that step taken, freedom for business enterprise and freedom for labor would be well on the way out.

Unfortunately, industry-wide bargaining is commonly regarded as presenting a general conflict between organized labor and employers, with unions favoring it and employers opposed to it. This mistaken notion raises the heat of much of the discussion without increasing the light. The fact is there is no such general conflict. Employers and organized workers are on both sides of the argument about industry-wide collective bargaining. For example, while some union leaders are characterizing as labor baiters all those who raise the slightest question as to the desirability of industry-wide bargaining, organized workers in the air transport industry are strenuously opposing that type of bargaining; and the employers are advocating it.

Some Employers Like It

The reason there is in fact no clear cut issue between employers and unions over industry-wide bargaining is readily understandable. It presents certain advantages to both sides in the bargaining process. For example, union advocates of such bargaining generally stress the fact that industry-wide agreement on wages protects wage standards from being undercut by lower wage areas and lower wage employers. By much the same token, however, employers who like it often emphasize the fact that industry-wide bargaining may save certain well-managed and prosperous companies from being singled out for particularly heavy wage exactions. This general point has been underlined in both the full-fashioned hosiery industry and the West Coast paper and pulp industry. There, local unions, affiliated with international unions, have protested that industry-wide collective bargaining prevents them from getting from especially prosperous employers wages as high as they could get if allowed to go it alone in collective bargaining.

So long as employers remain subject to the federal antitrust laws while unions are exempted, the balance of power in industry-wide bargaining would seem to be heavily weighted on the side of the unions. If, for example, employers were to announce an intention to match an industry-wide wage increase by an industry-wide price increase, there is no doubt that they would promptly be indicted for violation of the federal antitrust laws. Even so, the fact remains that some employers favor industry-wide bargaining while some segments of organized labor are against it.

A Clear Cut Public Issue

The industry-wide bargaining issue as it affects the public, however, is clear cut. It is concentration of economic power (in the hands of both unions and management) which can make industrial conflict devastating to the public welfare. At least five times within about a year—in steel, on the railroads, in the maritime industry and twice in the soft coal industry —strikes prompted by union efforts to impose industry-wide agreement about wages and working conditions have paralyzed large parts of the nation's economic life.

In soft coal about 90% of the production workers are members of the United Mine Workers. In steel

about 80% of the production workers are members of the United Steelworkers, C. I. O. In some other key industries there is a comparable degree of concentration of union control. In the face of such concentration many employers see no alternative but to get together on their side for industry-wide bargaining. But when they do so in key industries, the odds are lengthened that failure to agree on wages and related matters, will result in generally ruinous conflict. If agreement is reached, the chances are increased that it will take too little account of the welfare of the consuming public.

It is possible to have industry-wide bargaining on many subjects other than wages. *But the main interest is wages; and the main drive is toward industry-wide and ultimately nation-wide uniformity. Such uniformity is the deadly enemy of industrial decentralization and the pioneering expansion of industry in new areas.* Why pioneer, with inexperienced workers, if the wage rate must be uniform for the whole industry? Moreover, it would also be hard to conceive of a more effective way to put a blight on local efforts to improve industrial relations than to make wage rates and other working conditions uniform throughout the industry and then the nation. *However, among many other dangers, the overshadowing danger in industry-wide bargaining lies in its concentration of economic power.*

Wages Monopolized

On the average, the cost of labor accounts for about two-thirds of the total cost of all industrial products. The universal spread of industry-wide bargaining would thus concentrate in relatively few hands control of the greater part of the cost of industrial production. There is no reason to believe that even without disastrous strikes, such concentration would long continue free from government regulation. That would turn more earth for the graves of American business enterprise and American working men's freedom.

Those who believe that industry-wide bargaining serves the public well—and many sincere people do—stress the fact that, on the whole, it has worked in the industries where it has been tried over a considerable period. Most of the industries of which this is true, however, are not key industries. The pottery industry, the glassware industry, and the silk and rayon dyeing industry—to cite a few in which industry-wide bargaining has been practiced with considerable success—are important industries. But they are not industries in which strikes would have a ruinous impact on the nation. In contrast, a strike in the soft coal industry as the result of a breakdown of industry-wide negotiations quickly becomes a national disaster. The dangers inherent in industry-wide bargaining are multiplied accordingly.

England No Guide

Those who think extension of industry-wide bargaining would be good for the public often emphasize the fact that it has worked smoothly in England, where it has been extensively practiced. *Not the least of the things it has smoothed in England, however, is the transfer from private enterprise to state socialism of industries in which industry-wide bargaining by monopolistic unions and employer groups had so badly undercut competition that private enterprise had lost much of its justification.* A general extension of industry-wide bargaining could be expected to have the same consequences in this country.

The best way to curb industry-wide bargaining is a question which lies beyond this discussion. *Much would be accomplished if the federal government would discontinue its active promotion of industry-wide adjustments, in the fields of both labor and management, at which it has been busy ever since N. R. A. days. Still more would be accomplished if the federal antitrust laws were applied with even-handed justice both to unions and employers—a course urged in the 53rd editorial in this series.* Perhaps a definite limitation of the scope of labor agreements would also be necessary.

The effects of industry-wide bargaining in increasing the extent of public regulation of industry will vary. They will, of course, be less pronounced in railroads and other public utilities, which are already extensively regulated, than they will be elsewhere. For unregulated industries, however, industry-wide bargaining carries the threat of extensive regulation and, along the way, of industrial conflict devastating to the public. In these excited times, to say what I have said here is to invite characterization by overheated partizans as a foe of legitimate union progress. That is perhaps not so bad, however, as to qualify as a pall bearer for both American business enterprise and some of the basic freedoms of American working men. That may well be the fate of those who blindly accept the expansion of industry-wide collective bargaining as being "in tune with the times."

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

TAX REVISION...

Can Make or Break American Business

IS THE American way of life—progress by private initiative—going to get a fair chance to demonstrate its superiority over all the challenging varieties of collectivism?

That's the real question before Congress as it confronts the long labor of remodeling the federal tax structure. What Congress does about taxes will come pretty close to making or breaking the U. S. A.

Today the tax colossus that sprawls across the national economy is unguided by any central nervous system. Its crushing weight comes down first here, then there, as the giant wobbles around, unguided by any central purpose except to grab as much as it can.

The central purpose of a tax system is simple. It should raise the necessary revenue without placing unnecessary fetters on enterprise.

As recently as 1929 federal taxes took only one dollar out of every twenty of national income. A loose-jointed and inconsistent tax structure was a nuisance then. But it wasn't serious.

Today the federal tax burden is the dominant element in the nation's economy.

Even if Congress succeeds in cutting $6 billions out of President Truman's $37.5 billion budget, federal taxes still will take about one dollar out of every five of the national income. And few Congressmen are hopeful enough to think that they can get the tax load below $25 billion for any year that is in sight.

Drastic Budget Cuts Required

Indeed, to get the tax load down to $25 billion, Congress will have to stop treating expenditures, like those for military purposes and veterans, as politically sacrosanct. Congress must scrutinize *every* item in the budget. Economy must go along with tax cutting or we shall end in bankruptcy.

Suppose that expenditures are slashed to the bone. Our taxes *still* will be so heavy that the *way* they are loaded on the nation's back will make a big difference in how well the nation gets along. That's something which the postwar boom has tended to obscure. It will become much clearer as this boom wears off. Then a remodeling of the federal tax system to remove its manifold obstructions to private enterprise will be of transcendent and obvious importance to everybody.

Tax Experts Agree

The remodeling will require political courage plus tax wisdom. Congress must supply its own political courage. But it can lean on tax experts for tax wisdom. Fortunately, tax experts now agree on the necessary reforms—especially on those that will remove obstructions to business. How well the tax experts agree is shown in the charts on the next page, summarizing answers to a questionnaire on possible federal tax reforms. The questions were asked by the Department of Economics of the McGraw-Hill Publishing Company. The answers came from a broad cross-section of tax experts, including the authors of a considerable crop of books on postwar federal taxes and what to do about them.

The experts agree (see the charts) that double taxation of corporate dividends should stop.

They agree that the tax rate on corporate income (now 38 percent) should be reduced as rapidly as possible to the initial rate on individual income (now 20 percent).

And they agree overwhelmingly that it is desirable to let net losses be subtracted from net profits over a 5-to-6-year period in computing business income for tax purposes.

All three changes would stimulate corporate initiative and hence make jobs. Averaging business incomes would make new ventures attractive even though these ventures *might* result in early losses. Reduction of the corporate income tax would have the same effect. So, too, would the elimination of that highly discriminatory provision whereby corporate dividends are taxed first as corporate profits, and again when received as income by individuals.

Penalties on Incentives

Beyond these changes, there must be an end to tax penalties on *individual* initiative. Consider the enterprising business man whose income fluctuates markedly from year to year. Because of his enterprise he may pay, on the same income, twice as much federal income tax as the man who plays it safe for a steady income. That's because he can't average his personal income over several years for tax purposes. He can count on heavy taxation of his good-year profits with no chance for offsetting against them his bad-year losses. It is a case of heads you lose, tails the tax collector wins. Eighty-six percent of the experts agree that an income-averaging allowance for individuals is desirable.

Three-quarters of them also agree that tax rates at the top end of the individual income scale (now running up almost to 90 percent) should come down. In my judgment, the total tax should not amount to more than 50 percent to encourage business men to venture for high stakes.

Advocating tax relief for men in the higher income brackets—and particularly for management men—has been considered political suicide for more than a decade. Some members of Congress still hold that view. A Democratic Congressman from Michigan told an Illinois colleague who advocated cutting upper bracket taxes, "If you put that idea forward at home, you won't come back."

The Congressman has an even better chance of not going back if our economy bogs down. One of the best ways to bog it down is to keep the taxes that destroy business incentives and block enterprise—for example, the confiscatory rates which drive the people in the high brackets away from risk-taking.

To give the American system of individual enterprise a fair chance was clearly the mandate of November's election. To give it that chance, enterprising business men must have a chance to make large rewards—as well as the always-present chance to lose their shirts. Under present tax rates, they don't get a break.

Prevailing federal taxation throttles bold business enterprise in other ways. It fails, for example, to encourage research and rapid industrial modernization. It tends to siphon investment away from private enterprise, driving it into tax exempt state and local securities. (The experts agree almost to a man that such tax exemption must be eliminated.) The list of obstacles could be amplified.

Hit-and-Run Revision Disastrous

Most of the reforms needed to prevent the federal tax system from smothering enterprise would lower federal revenues, at least temporarily. Elimination of the double taxation of corporate dividends might lop off $800 million. Dropping the corporate income tax from 38 percent to 20 percent might cut away as much as $4 billion.

EXPERT OPINION ABOUT TAX REVISION

TAX EXPERTS THINK WE SHOULD:

% Of Tax Experts Favoring the Proposed Changes

1 ***Eliminate double taxation of corporation dividends*** which are now taxed as corporate profit and then again as individual income.

2 ***Reduce corporation income tax rate (now 38%)*** as rapidly as budget needs permit until it equals the initial rate for individual incomes (now 20%).

3 ***Provide for averaging business' taxable incomes*** over a period of about 6 years to allow for losses in bad years.

4 ***Provide for averaging individuals' taxable incomes*** over a period of a few years so as to treat fairly those whose incomes fluctuate.

5 ***Reduce upper bracket individual income tax rates*** to a maximum of 50% in the $100,000 bracket and 75% in the million and over bracket.

6 ***Treat capital gains, now taxed at a lower rate,*** like other income but provide full allowances for losses.

7 ***Remove the privilege of tax exemption*** from all future issues of state and local government bonds.

Because we can not avoid enormous federal expenses in the years immediately ahead, all badly needed reforms of the type to which this article is confined obviously can't be made at once. Also there are other tax reforms bearing on consumption which obviously should be weighted in an over-all program of tax revision.

But this is equally obvious: We should have a general design for tax revision which would line up all the necessary steps. Then we could get ahead with tax reductions as rapidly—and as sensibly—as revenue requirements and political courage would permit. Tax cutting may come piece-meal, but tax planning must not.

Through such a design we might discover that some decidedly beneficial improvements in the federal tax structure can be made at relatively slight cost. But today there's no way to be sure. No one in Washington with access to the information has even undertaken to make the necessary estimate.

Instead, federal tax revision continues to be a hit-and-run business—and a short-run political business. Take, for example, the proposal of a 20 percent tax reduction across the boards. There are virtues in such a proposal. But how they stack up beside many other extremely urgent needs for tax reform remains a mystery.

Congress must dispel such mysteries. Only in that way will it do the job of converting our present jerry-built tax structure into a moderately safe abode for the American system of private initiative, sparked by adequate incentives.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 56TH OF A SERIES

OUR TEACHERS—

They Need The Help Of Business Now

THIS is an appeal to raise school teachers salaries—fast. Such appeals are commonly addressed, rather vaguely, to the conscience of the community. This one is not. It is addressed directly to the business community, and to its hard core of common sense.

As a whole, the school teachers of the nation are taking an economic beating. So, too, are their close associates and co-workers, the librarians. In purchasing power, public school teachers salaries, after taxes, average about 20 percent less than they did eight years ago. Beginning salaries of librarians, always low, have fallen behind an equal amount in purchasing power. College and university teachers are not much better off. The pressure is particularly heavy on those in the lower ranks. As a group, teachers and librarians are close to the bottom of the economic heap.

Unless this situation is remedied promptly, it is confidently to be expected that:

1. The more competent teachers will continue to desert our schools in droves, and our libraries will remain inadequately staffed. More than 350,000 teachers — many of them the very able ones—have left the public school teaching staff of about 900,000 in the last six years. More than 100,000 of the replacements are "substandard." They cannot meet the minimum educational requirements of their jobs which, by admission of the profession itself, are none too high.

2. Those who remain will be organized increasingly into economic pressure groups. Teachers strikes and the rapid growth of unionism among teachers at present clearly indicate what is in store.

Many business men are so deeply disturbed by the resort to the strike weapon by some teachers to enforce their salary demands that their sympathy for the general plight of our teachers tends to be dulled. Such an attitude is understandable. It avails nothing, however, in eliminating the crisis in education caused largely by teachers salary troubles.

The crisis in education is a crisis for the nation as a whole. The work of our schools, colleges and libraries is such that its deterioration means deterioration of the nation. However, the salary crisis in education is in special measure a crisis for the business community. That community has a special stake in having a well-educated and well-disposed constituency.

Education and Unionism

There may be room for disagreement as to whether teachers should organize themselves in trade unions, and follow trade union tactics. However, there is no conceivable room for disagreement as to whether organization of teachers into a fighting economic pressure group under the lash of a teachers salary crisis would be a body blow to business. Among many teachers it would foster an abiding hostility to the institution of business which, occupying a key position in the life of the community, had not done its utmost to make such unionization unnecessary by taking a lead in relieving the teachers salary crisis.

In our work of publishing technical periodicals and text books, we at McGraw-Hill meet and come to know many teachers and librarians. We know that, as a group, they have little appetite for participation in militant economic pressure groups. They are far more interested in making a militant assault on ignorance and prejudice through concentration on their professional work. If, through neglect of their economic needs by the business community, they feel forced to resort to trade union organization and tactics, the teachers and librarians can be expected to have an abiding re-

sentment toward the institution of business. That resentment will, in turn, be communicated in no small measure to the coming generation. Such is the nature of the educational process.

The crisis in education is not, of course, exclusively a matter of salaries. Unsatisfactory working conditions also play a part. Many schools are dilapidated and terribly overcrowded. So are some libraries. Some small-town school boards oppressively insist that the school teachers be the paragons of piety the board members wish they were themselves. Protection of a proper degree of academic freedom is sometimes missing. The teacher is rarely accorded a prestige comparable to the importance of the job. Elements such as these aggravate the crisis in education. But the first and absolutely essential step toward surmounting the crisis is to provide tolerable salaries.

Because of the enormous diversity of local conditions affecting teachers and librarians salaries, no general rule for emergency action would fit all cases. From state to state, average yearly expenditures on education in 1940 varied all the way from about $30 per pupil to about $150. Some states, like Nebraska, finance their schools almost exclusively from local taxes. Others, like Delaware, rely almost entirely on state taxes. Some states and communities have already acted to meet the salary crisis. Others have not. Variations such as these limit any generalization.

Guide for Emergency Action

But as a general proposition it can be safely said that the minimum requirements of the emergency will not have been met so long as the salaries of class room teachers and junior members of college faculties and library staffs have not been increased by the amount necessary to keep them abreast of the increase of about 50 percent in the cost of living since 1939. In many cases, a temporary cost of living adjustment might prove the best way to handle the problem.

This suggestion, let it be repeated, is not offered as a solution of the salary problem, but as a start. With their salaries increased enough to meet the increased cost of living, the teaching and library groups as a whole would still have cause to envy the current economic position of industrial workers. Since 1939, the average of weekly earnings of industrial workers after taxes, has outstripped the rise in the cost of living by about 21 percent.

However, a start and an absolutely essential start would be made toward giving America the sort of educational system it must have not only to fulfill its ideals but holds its own in this highly competitive world. We worry, and I think rightly, about having the free world engulfed by Russian Communism. According to the best figures available, the U.S.S.R. is spending about twice as large a share of its total national income for education as we are. The figures compared include our expenditures for both public and private education. That comparison is really something to worry about.

States Should Take Lead

In dealing with the salary crisis it is up to the teachers to display a maturity and integrity worthy of their profession. Teachers have many employment advantages, such as long vacations. They should not slur them over in making comparisons of their annual incomes. Also employment in teaching and libraries has been notably stable. Teachers and librarians should not ignore that fact in comparing their position with those whose employment has been far less steady.

At the same time, the great fiscal difficulties involved in solving the crisis in teachers and librarians salaries must not be used as an excuse for postponing effective action. The states are better equipped financially and otherwise to take such action than is the federal government and, with the localities directly involved, should take the lead. If the price of effective action is a heavier tax burden for communities already too heavily burdened that price must be paid. The crisis presents a major emergency. To handle it as anything less is to court irreparable damage to the nation as a whole, and a special measure of damage to business as well. The intelligent self-interest of business requires that it leave nothing undone to meet and master the crisis in education.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 57TH OF A SERIES

WORLD LEADERSHIP...

Our Duty and Our Opportunity

CAPITALISM in Europe and the rest of the world is challenged by a real and formidable rival, communism. For capitalism to thrive a reasonable amount of prosperity is essential. Communism uses poverty to advance itself.

Except for the Western Hemisphere, most of the world came out of the war poor. Two years after V-E Day it is still poor. It needs dollars. It needs credit. It needs capital. It needs trade. It needs technical and managerial skills.

If we in America are to help the rest of the world back to its feet, starting it again on the road to peace and a free economy, we should try to supply those needs within the limits of our capacity.

We must not overtax our own strength. For the first requirement of a stable world is a strong United States. But we must accept leadership in international economic recovery—in our own self-interest.

What can the United States do to help men back to prosperity in a world economy which will allow them *freedom and incentive?* There are many things. But here are two of the most important:

1. The United States, through Congress, must determine the pattern and the total of the foreign loans or grants it can afford. We must answer three questions. How much will the new program cost? Can we afford it? Have we the technicians and managers to watch the loans, assuring their fruitful use?
2. We must demonstrate that we do not intend to raise our tariff walls to prohibitive heights when our debtors begin to repay us in goods and services, which is the only practical way they can pay us. Otherwise our loans will become losses.

If the United States is to meet even the minimum requirements of world rehabilitation, Congress eventually must authorize more advances than those to Greece and Turkey. The $400 million for those two countries will not do the over-all job of political and economic defense which we have begun. A minimum of $5 billion, if promptly and wisely applied in eight to ten countries, might suffice. BUT this $5 billion will be on top of approximately $16.8 billion which we have spent or earmarked during the past two years for use abroad, including our full share of the World Bank and Fund. We shall do a faster and more effective job if Congress will thus add up the foreseeable total of our international aid, and, even though the total looks imposingly large, commit us to it, with proper collateral safeguards from the debtor nations.

Congress need not try to foretell all contingencies, like last winter's weather in Britain, and it certainly should not create the impression that nations need only ask for billions to receive them. On the other hand, the war should have taught us the miserable consequences of "too little and too late." The President should have learned that he engenders skepticism by going to Congress with parts of a program, as he has done in the British, Grecian and Turkish loans. Within the limits of our capacity, we must make the decision now to see the whole job through—or throw in the sponge.

In the interest of the debtor nations—as well as in our own interest—the loan program should be hard-boiled. Rehabilitation loans must really rehabilitate. They must produce a state of economic health which will permit the World Bank and private capital to take over the task of financing world recovery—as perhaps can be done today in France and the Low Countries.

The loans, therefore, must be within the limits of our technical and managerial ability to implement them. Without technical help, Greece can not use its loan effectively—to rebuild railroads, clear ports, revive agriculture. Without skilled supervisors, Germany can not be made to pay its way. Money alone won't pull China from the brink of economic chaos.

Our lending calls for more than money. It calls for trained personnel to help the recipients utilize the loans effectively—geologists, construction and sanitary engineers, monetary experts, and management and agricultural specialists.

Loans are necessary but they are only a first step. A long-range program requires the opening of the half-closed doors of world trade—our own door, too.

We will have to get used to the idea that, when our debtors pay us, they must pay us largely in goods and services. Refusal to permit such repayments in the twenties helped start the world depression in the thirties—and the loss of our investments. *Imports do tend to raise living standards, and a two-way trade program need not require us to slash our present tariff rates.*

The complexion of our foreign trade has changed since the war. Our manufacturing capacity has increased and our raw-material self-sufficiency is tending to decline. For example, we probably shall have to continue importing copper and zinc and to increase our prewar dependence on imported lead. We may soon have to depend heavily on imported oil, and—gradually—on a growing volume of iron ore from abroad. Our normal dependence on imports for commodities like rubber, tin and silk will continue.

Our population has gone up 10 million in the last decade, and we now have a $176 billion national income, making room for more imports.

As a result of every nation's recent attempts to make itself secure and self-sufficient by slamming its trade door, a world-wide series of quotas and restrictions is blocking international trade. Even more, government buying and selling threaten to take commerce out of the hands of private traders, placing it in the uninspired care of bureaucratic negotiators.

Our government has taken the lead in calling the conference of 18 nations, now meeting at Geneva, to open as many trade doors as possible. The American delegates will bargain product by product and country by country—all summer, if necessary—for lower tariffs, fewer quotas and a free flow of *private* trade. The task is a long one, and the results are as yet uncertain, but, if success is achieved, an immense opportunity for good works and good earnings will lie before American businessmen.

This is no picayunish opportunity. Authoritative estimates put our 1947 exports at $11 billion and our imports at $6 billion. That's substantial. It is greater than the value of all crops grown on our farms ($10½ billion) and exceeds the value of all shipments of industries such as automobiles ($9 billion), textiles ($8 billion) and chemicals ($8 billion).

International trade is vital, not to be shrugged off, not to be kicked around as a football of party politics. Republicans and Democrats agree on a non-partisan foreign *political* policy. They should agree also on a non-partisan foreign *economic* policy. The foreign relations of the United States, political or economic, can no longer be log-rolled hither and yon.

A general program for international recovery, outlined here, will bring its full quota of aches and pains. But lack of a program will produce economic and political troubles on a vast scale; timid retreat will invite economic disaster and war.

By an intelligent, bold and resourceful program, we have a chance to win through to a long peace in the kind of world we want. *Unless America provides the leadership, there can be no such program.* Then Communism merely needs to hang around long enough to pick up the pieces.

Ours is the responsibility and the opportunity.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

A NEW ENTERPRISE

Advocacy by the McGraw-Hill Publishing Company, in the accompanying editorial, of an effective world economic policy is not a mere verbal exercise. In the faith that we as a nation shall develop such a policy, this Company, following a trail blazed by leaders in American industry and finance, is expanding its operations overseas.

A newly created McGraw-Hill International Corporation will push forward the frontiers of our technical magazine and book publishing business throughout the world. The new Corporation comprises:

Eight international magazines—the McGRAW-HILL DIGEST, THE AMERICAN AUTOMOBILE and EL AUTOMOVIL AMERICANO, PHARMACY INTERNATIONAL and EL FARMACEUTICO, INGENIERIA INTERNACIONAL CONSTRUCCION, INGENIERIA INTERNACIONAL INDUSTRIA, THE MACHINIST.

A newsgathering agency, McGRAW-HILL WORLD NEWS, specializing in industrial and engineering coverage with correspondents in 36 world centers.

McGraw-Hill Publishing Company, Ltd. (London), serving the special needs of Britain and western Europe and publishing THE MACHINIST (London).

Five buyers' guides—AUTOMOTIVE EQUIPMENT (in English and Spanish), CONSTRUCTION EQUIPMENT, INDUSTRIAL MACHINERY and PHARMACEUTICALS (all in Spanish).

In addition, the McGraw-Hill Book Company has an overseas network for the distribution of its books.

THIS IS THE 58TH OF A SERIES

YOUR CHANCES OF GETTING AHEAD

FOR 20 years we have been whittling away the foundations of our economic structure. We have been cutting away the incentives to "get ahead in the world," to increase production and to improve efficiency. Unless this process is reversed soon, we risk the sort of industrial stagnation that currently afflicts Great Britain so disastrously.

How far the whittling has gone is shown by the statement in the center of the page. It shows that everyone's stake in working harder and getting ahead has been reduced sharply since 1929. In that year, anyone who was even moderately successful could look forward to reaping the rewards of his success. If he earned $5,300 annually over a period of 25 years he could retire on a comfortable income of $3,000 per year. Or he could pile up enough capital to go into business for himself. He could fulfill the American dream as phrased by Abraham Lincoln in his first annual message to Congress in 1861:

"The prudent, penniless beginner in the world, labors for wages awhile, saves a surplus with which to buy tools or land for himself, then labors on his own account another while, and at length hires another new beginner to help him. This is the just and generous and prosperous system, which opens the way to all, gives hope to all, and consequent energy and progress, and improvement of condition to all."

Look at the situation today. To retire on an annual income from investment that will buy as much as $3,000 did in 1929, a young man needs to earn over $13,000 a year for 25 years. That's more than 2½ times the income he would have needed in 1929. The same thing is true of acquiring a stake in a business.

Why Try to Succeed?

While the income needed for retirement today has increased 2½ times — or by more than 150% — since 1929, the average person's income has increased only 80%. So the average man's chances of achieving success are really slimmer now than a generation ago.

This 1929-47 trend is something new in America. The average person's chances of getting ahead improved during 1914-29. In that period the dollar income needed for retirement or a stake in business rose by 75%, but the average income rose by 100%. So more people were within striking distance of success and security in 1929 than in 1914. The story has been different since 1929.

Fewer people actually do achieve financial success today. Only 1% of all families now have incomes large enough to build up a retirement fund or a stake in business. In 1929 almost 6% of all families attained a comparable degree of success.

Higher taxes are the most important reason why it takes so much more now to build up a competence. They account for one-half the increase in the amount needed. The other half is explained by higher living costs and lower interest rates.

It is, of course, true that few people ever get into the higher income brackets. So the process of cutting

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YOUR CHANCES OF GETTING AHEAD

To see how your chances of getting on in the world have changed during the past few decades, the McGraw-Hill Department of Economics has calculated how much it now takes to save enough to acquire a retirement income or a comparable stake in a business, as compared to what it took in 1914 and 1929.

The objective set is an income from investment equal to $3,000 a year in 1929 dollars. It is assumed that the savings required to yield this income are made over a period of twenty-five years. During that period it is also assumed that $4,000 per year (in 1929 dollars) is spent on living expenses.*

Here is how the figures work out:

	Yearly Income Needed
1914	$3,075
1929	5,267
1947	13,221

It now takes more than four times as large an annual income as it did in 1914 to gain a comparable stake. It takes well over twice as much as it did in 1929.

Changes in three factors — federal income taxes, living costs, and interest rates — explain why the income needed has multiplied so. Here's how these factors line up for the three years.

	Federal Income Taxes Married Man, 2 dependents		Cost of Living (Index Numbers 1935-39)	Interest Rate High-grade Corporate Bonds
	$5,000 income	$10,000 income		
1914	$10	$60	71.8	5%
1929	$3	$40	122.5	5%
1947	$589	$1,862	155.0	2½%

Similar calculations show that if we could reduce federal expenditures from $35 billion to $25 billion annually, raise interest rates by one-tenth and lower living costs by 15% — all realistic possibilities if we make the effort — then the income needed to build up such a retirement fund would come down to $9,500. The chances of realizing that goal would then be restored to what they were in 1929.

*Several other factors were omitted from the calculations because they would not have a decisive effect on the results. Thus, existence of social security pensions and retirement funds now reduces the income needed; but if state income taxes were added, the income needed would increase.

away the incentives which play such a key role in our economic system affects comparatively few people immediately. It does, however, have a powerful indirect effect on all of us.

Everybody Loses

When half to four-fifths of any additional income of successful people goes to Uncle Sam a heavy drag is obviously put on doing the work to get it. Thus, we stand to lose the benefit of full use of the nation's best brains. By so doing we stifle industrial progress. And the loss in productive efficiency far outweighs the tax revenue the Treasury gains. Carried far enough, the process of stifling economic progress by slashing rewards leads straight to industrial stagnation.

The same process also multiplies the risks of embarking on new capital investment. High taxes rule out all but the most profitable new projects and restrict most expansions to boom times when profits are high. So capital investment follows a boom and bust pattern and, by so doing, contributes much to ups and downs in production and employment.

The Sorry Plight of Britain

The case of Britain today provides an object lesson of how blighted incentives produce industrial stagnation. *Britain's number one economic problem is to get more production. But the tax load there is so heavy it stifles the incentive to produce more.*

A coal miner who works an extra shift pays about a third of his added earnings to the tax collector. And, as the London *Economist* comments, tax rates on business executives are so high that they kill every incentive except that to tax evasion. In short, not only is the incentive to succeed blighted, but so is the incentive to work.

A root-cause of Britain's trouble is this: The cost of an expensive program of social benefits has been piled on top of the heavy costs of paying for past wars and trying to prevent future wars. Tax rates are boosted accordingly. What her experience proves is that the attempt to provide excessive social benefits may defeat itself. It raises the tax burden on rich and poor alike and smothers the incentive to work. So the underlying basis of all economic benefits—production—is eaten away.

We in the U. S. haven't traveled as far down the stagnation road as Britain has. Taxes amount to about 26% of national income here as against about 45% there. But, unless we start soon to build up incentives to do better work, instead of whittling them away as we have been doing, we will catch up with Britain fast.

It's Late but Not Too Late

Can anything be done? Decidedly yes, *particularly by tax reform and reduction in the cost of living.* As far as interest rates are concerned, any large increase would raise excessively the cost of carrying our war-swollen national debt, and hence raise taxes. But some increase in what are now excessively low interest rates may well be both feasible and desirable.

Action on the tax front is the first order of business. Our jerry-built tax structure is the thing that is chiefly responsible for cutting the incentives to work harder. Two things are important: 1) Government spending must be pared to the bone; 2) The tax system must be completely overhauled to remove the shackles on all-out production.

The 56th editorial in this series, published in March, outlined major steps that need to be taken in remodeling federal taxes in order to increase incentives to individual and business enterprise. *The revenue bill now before Congress is no more than a short step in the right direction. Much more must be done to clear the way for high production and rising living standards.*

Lifting the blight which taxes now place on incentives would help cut the high cost of living. It would stimulate greater production and greater efficiency. But a further step is necessary. Part of the benefits of improved efficiency must be passed on to consumers in the form of lower prices.

In the past few years we have been following precisely the opposite course. In many cases wages have been increased all out of proportion to increased productivity. Result—soaring prices and a severe squeeze of the consumer, to which some greedy exploitation of war-created shortages has also contributed.

To Give Ability a Chance

Our basic and most crucial problem is to get back on the track which leads to higher production and improved living standards all along the line. We got off that track in the 30's. Then, we started scrambling for larger slices of the same pie instead of trying to produce a larger pie. Now the process of getting back on the track is greatly complicated by the tremendous tax burden growing out of the war.

Yet it's not too late to turn back from the road that leads to industrial stagnation. As the statement in the center of the page shows, we could restore the odds of getting ahead to what they were in 1929. Cutting the federal budget to $25 billion a year and putting the tax structure in good order are the crucial first steps.

By taking these steps soon, Congress can go far to restore the incentives to hard work and efficiency which have been so largely washed away in the past 20 years. If they are not taken the American dream of getting ahead by hard and effective work will exist only in the history books, and our children will inherit from us an economic order without opportunity, without hope, without individual liberty.

James H. McGraw, Jr.

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